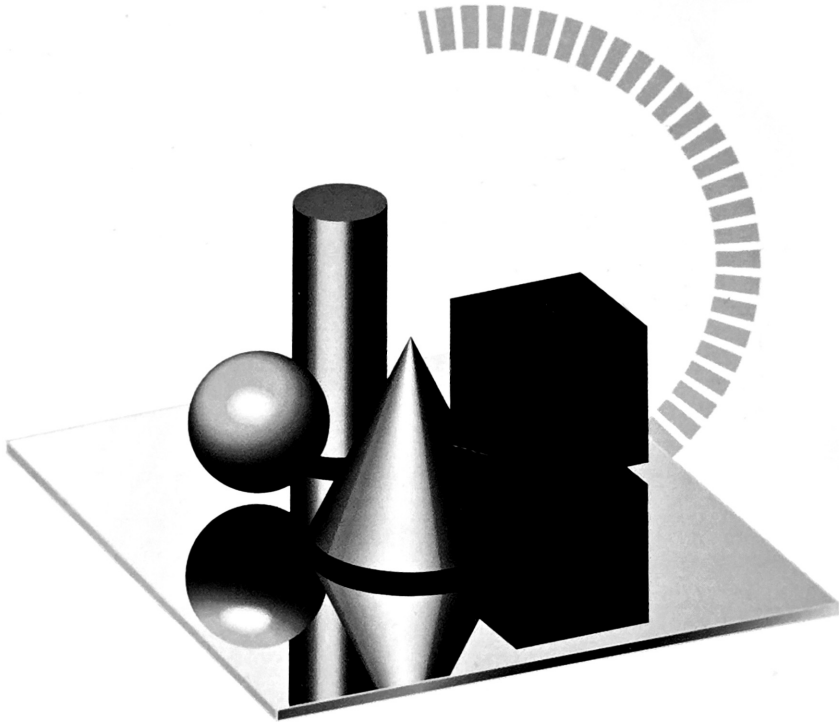
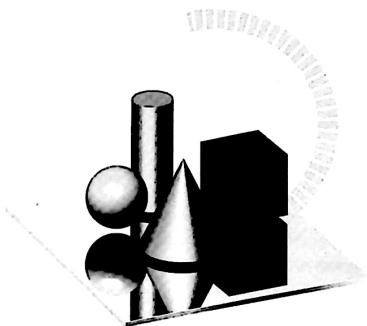


Cinema4D™



User Manual

HiSoft
SYSTEMS



Cinema4D for the Amiga

By Maxon Computer & HiSoft

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Introduction

Congratulations on your purchase of Cinema4D. We are sure this program will become a valuable addition to your software collection and an indispensable companion for you and your computer.

Cinema4D has been created, and modified, over a three-year period. We have tried to implement all the features that we, and our testers, believed would be of use for the Amiga user. However, should you think there is a function missing from Cinema4D, write and tell us. Only through user feedback can a program like this be further developed. We are grateful for any constructive criticism or suggestions for expansion.

One of Murphy's laws read thus: *a program either has bugs or is obsolete*. No programmer can get rid of all the bugs especially in a new program and, although Cinema4D has undergone extensive tests, should you discover problems, that seem to be bugs, please share them with us. We hope you enjoy using Cinema4D!

Making a Working Copy

Before using Cinema4D you should make a back-up copy of the distribution disk and put the original away in a secure place; safe from extremes of temperature, magnetic fields, moisture and children! The disks can be backed-up using the Workbench or any back-up utility - before making any backup always write-protect the masters to prevent accidental erasure.

The disks are not copy-protected to allow easy back-up and to avoid inconvenience; remember though that the software and this manual are protected by international copyright laws and you are only permitted to copy the software for your own personal use. If this sounds officious, look at it another way - if you give away copies of Cinema4D to your friends we will not receive enough revenue from the sale of the package to improve this and other products. We want to help you, please help us in return.

Registration Card

Enclosed with this manual is a registration card which you should fill in and return to us in order to register your purchase of Cinema4D. This will entitle you to a free period of technical support and will enable us to keep you informed of future developments to our software.

For details of our technical support services, please refer to the appendices at the back of this manual.

You will need to quote your serial number (to be found on the disk label) to obtain technical support and you may find it useful to make a note of it here:

Serial No.

Requirements

As with all programs Cinema4D has certain requirements that your computer must be equipped with.

Cinema4D will give best results on an Amiga with Kickstart 3.x, 4MB RAM and a fast processor (68020, 68030 or 68040). But don't worry, Cinema4D does work on Amigas with a humbler specification. Minimum requirements are 3MB RAM, Kickstart 2.0 (or higher) and a hard disk. A faster processor isn't a necessity either, a 68000 will be enough.

Installation

Cinema4D is easily and automatically installed on your Amiga using Commodore's Installer program.

Insert the first disk into any available drive and double-click on the Install-Cinema4D icon. The installer gives advice on how to proceed and for every choice there is on-line help.

Manual Organisation

1. Introduction & Features

2. Tutorial

3. Basics

4. Reference

5. Appendices

The manual is subdivided into various sections. First is the introduction which you are currently reading, followed by the Tutorial section which introduces Cinema4D's most important functions in a quick and painless manner. If you've never used Cinema4D before, you should work your way through this section before using Cinema4D on your own.

The Basics section explains important principles for working with Cinema4D. You should definitely read through this section.

Next up is the reference section. This fully describes all the functions built into Cinema4D and should be used as a reference.

The Appendices contain a glossary, bibliography, and support details.

Foreword

Dear customer,

We welcome you to the virtual 3D space that is Cinema4D!

Cinema4D is one of the easiest-to-use, high-end systems available.

Cinema4D is the product of six man-years of development. The program will continue to be developed and improved - the end is not yet in sight! Our thanks go to all our users who have sent us criticisms and suggestions for further development. In fact, many of the suggestions have been incorporated into the current version of the program. Please let us know what you think of Cinema4D.

At this point we would like to thank honest people who have bought this product, you have allowed us to continue development. Please don't give Cinema4D to anyone else, not even "just this once". You must surely know that copying software is illegal.

Cinema4D offers you revolutionary innovations. Cinema4D is the first Amiga program world-wide to have been programmed following ergonomic principles. Witness the logically arranged, style guide-compliant interface; completely flicker free, interactive, full feedback, full-speed and based on intelligent, mode-free principles which set tasks running in the background.

The philosophy for Cinema4D is that the program should adapt to the user, not the other way around.

We hope you have great success in working with Cinema4D!

Christian and Philip Losch (October 1994)

We recommend using Kickstart and Workbench 3.1. It gives you much faster operation, and Cinema4D uses many of the new features of this version of the operating system contains.

Performance Data

As a taster for Cinema4D's functions here is a truncated list of what Cinema4D can do for you:

Use and Ergonomics

- High-speed operation and fast screen updates.
- Interrupt rendering at any point.
- Document-oriented.
- Simple, logical and quick.
- Asynchronous and mode-free windows.
- Interactive real-time display.
- Intuitive camera placement in real-time.
- Quick access to important functions through button bars.
- Keyboard shortcuts to speed up work.
- Work to exact measurements entering all parameters with the mouse or numerically with the keyboard.
- Shallow learning curve.

Interface

- Freely positionable gadget windows.
- Arrange the layout to your taste and save it.
- The display can switch between top-down, front-back, side-to-side and 3D view or a combination of all four, together with a perspective mode.

- Work on an object in all views (including perspective) at the same time.
- User-defined editor resolution and aspect ratio.
- The editor runs on Workbench.
- Object and point descriptions.
- Reduced display styles for faster object development.

Numerical

- High internal precision.
- Integrated parser for mathematical expressions like +, sin, abs, etc.
- Use of distance and weight measurement systems means accurate to-scale models.

Objects

- Unlimited number of objects.
- Thirteen different, adjustable primitive objects.
- Five different, adjustable polygons.
- Five different, adjustable special objects (Figure, Fractal, Emboss, Sun and Text).
- Fractal landscapes.
- Emboss gives a picture depth in three dimensions.
- Unlimited spline objects which can be used to create a contour through rotation, movement and warping, or several contours by connecting them together.
- Rounding of corners.

- Object smoothing using the Phong method.
- Hierarchical object system ensures easy and efficient object management.

Polygons

- Unlimited three-dimensional polygons
- Four different spline interpolations (Linear, Akima, B-Spline and Cubic)
- Vertices can be moved, rotated, scaled, quantized, levelled, etc.
- Vertices from other file formats can be imported (e.g. contour points from a map).
- Unlimited elements
- Points, edges and faces can be moved, rotated, scaled, etc.
- Magnetism for interactive deformation of objects.
- Selected elements can be passed on to new objects.
- Import external point data.
- Interactive real-time input and manipulation.

Functions and Tools

- Rotate, move, scale and drawing in real-time.
- Efficient temporary store for convenient transfer of files between documents.
- Intelligent input windows - invalid inputs are impossible.
- Boolean operations.

- Flip, warp, arrange, centre, crunch, deform, subdivide, randomise, transfer, optimise, join, repair, twist, display, align, smooth and many others.
- Drag mode for inverse kinematics.

Materials and Textures

- Extensive and expandable Material library with glass, wood, plastic metal, etc.
- Colour, transparency, specular, reflectivity and refraction are all definable.
- Relief mapping to give a realistic look to 3D surfaces.
- Input as RGB or HSV.
- Flat, cylindrical or spherical mapping.
- Colour, transparency, reflectivity, relief, specular and luminosity textures.
- Texture tiling.
- Render IFF picture in any resolution, with any number of colours (from 1-24 bits per pixel), and onto any available screenmode (HAM6, HAM8, EHB).
- Textures can be manipulated and placed on objects in real-time.

Light Effects

- As many lights, of any colour, as you like.
- Divergent and parallel light sources.
- Shadow casting.
- Spotlights.

- Fog effects.
- Sunlight (colour and position depending on geographic location, time of day and year).
- Ambient light.
- 18 different light source styles.

Rendering and Output

- Six different render modes, from Wireframe, through scanline, all the way to ray-tracing.
- Many different quality levels and options.
- Separate ray-tracer to optimise memory and multitasking.
- Adaptive, optimised ray-tracer in combination with scanline rendering.
- Scanline algorithm reflects the Ground and Sky in objects.
- Complex and fast algorithms.
- First-rate qualitative anti-aliasing.
- Rendering works on all available Amiga screenmodes (including AGA and ECS) and in all colour depths to 24-bit.
- Supports the Retina, Picasso, Merlin and all EGS graphics cards (Piccolo, Domino, Rainbow II/III, GVP EGS-110/24, IV24, Visiona, Videolayer, etc.).
- Reacts to any other graphic card through libraries.
- Simultaneous output to hard drive with any resolution and 16 million colours.
- Background picture underlay (any resolution).
- Foreground picture overlay (any resolution).

- Selectable pixel aspect ratio for the output medium (i.e. PAL 4:3, HDTV 16:9).

Animation

- Keyframe animation for bodies, light sources and the camera through interactive definition of support points (keyframes for position, size, direction, material and texture), in real-time.
- Path animation for any object by assigning it to a polygon.
- Genuine hierarchical animation.
- Inverse kinematic animation using drawing functions make skeletal and character animation for figures possible.
- Hitch objects to another path (alignment).
- Time Line gives graphical control over an animation.
- Use the time control for exact timing in animations.
- Acceleration, braking and complex speed control functions.
- Selectable distance and time interpolation styles (jump, linear, B-spline, Akima, cubic).
- Object, camera, material, texture, light and sun animation.
- Many special effects - explosion, wind, melt, etc.
- Background, foreground, Sky and Ground animation.
- Easy playback of animation with controls for set, start, stop, fast-forward and rewind functions.
- Preview function - play any length of animation back in real-time, from the editor, hard drive or memory.

File Format and Expandability

- Future-proof, efficient, documented and backwardly compatible IFF format.
- The MagicLink converter reads and writes Cinema4D, FastRay, Imagine, Reflections, Turbo Silver, Videoscape, Sculpt, Pagerender and DXF formats.
- Documented expansion interface.
- External expansion modules available to buy.
- The documented interface allows you to expand your range for functions by installing your own, or commercial, program modules.

Contents

- Extensive manual with reference, tutorials and glossary.
- The package contains an editor, ray-tracer, converter, scenes, objects, a material library, textures and pictures

Tutorial

This tutorial introduces you to simple use of Cinema4D's interface and helps you along the way with plenty of examples. The tutorial assumes no previous experience of Cinema4D, although you should be familiar with basic Amiga and Workbench operations. If you already know Cinema4D, you can skip the tutorial section and head straight for the reference section of this manual.

1. *The User Interface*

In spite of a vast array of functions, Cinema4D is still one of the most friendly and easy-to-use programs. The reason for this is due to Cinema4D adhering closely to the guidelines laid out in the Amiga style guide, thus ensuring a consistent user interface. This means that certain elements of the program, particularly those encountered frequently, always have the same meaning and interface. In addition, there are no functions that don't return feedback. If invalid or incorrect data is entered, then Cinema4D will inform you. If Cinema4D is engaged on a long calculation, you will always get the busy pointer informing you of this. Cinema4D is also unique in allowing you to interrupt the drawing process at any time. This avoids the tiresome hanging around waiting, for the screen to redraw. All these features guarantee that you will find Cinema4D quick and easy-to-use:

Once you have started Cinema4D, have a look through the menus. You will notice the fact that there are three varying types of menu items. The first contains just a single entry, such as "Delete", selecting an entry such as this makes Cinema4D carry out the desired function immediately.

The second type of menu entry contain three dots (an ellipsis), after the entry e.g. “Open...” or “Insert...”. The ellipsis indicates that an entry, or set of parameters, are required before the function can be fully executed. After selecting an ellipsis entry, a window will open into which you can enter parameters for the function (e.g. path or filename). Once the parameters have been entered, select the OK button to complete the function.

Lastly, you will see functions that have a “•” after the name. These functions indicate that they have values which can be edited. When you select a menu item with a dot next to it, such as “Torus •”, its function will be instantly executed using the functions pre-defined defaults. If however you select the function while holding down the shift key, a new window will be opened containing settings for the function.

By using this menu structuring, Cinema4D prevents the problem of overloading a new user with too many options.

Cinema4D is also unique in having keyboard shortcuts for virtually every function. At the end of each menu item you will see a key combination. As an example, try calling the “Open” function by holding down the <Right Amiga> and <O> key combination. As you gain experience with Cinema4D, you will find that keyboard shortcuts will dramatically increase the speed at which you can work.

Keyboard shortcuts are also available within input windows; shortcuts can be used to active function and switches. These shortcuts can be seen if you look closely at the field names. Many of the names have a letter that is underlined, try selecting the corresponding key on the keyboard to activate or deactivate the field.

In general, Cinema4D reserves the letters “O” and “C” for use with the “OK” and “Cancel” buttons in input windows. Cinema4D also allows you to cancel a window, at any time, using the <ESC> key.

Upon closing an input window using the OK button, Cinema4D immediately checks the validity of all the values you entered. If, for example, you have entered a rotation of 92.3 when the maximum allowed is 90°, Cinema4D will inform you of this, and return you to the field that needs correcting.

To speed up the entry of data into complex input windows, you can use the Amiga <TAB> key to cycle the cursor from one field to the next. If you hold down the shift key with the <TAB> key, then the entry cursor will cycle through the fields in reverse order. The same functions are also available using the up and down cursor keys.

2. *It's all a matter of opinion*

There are various methods of displaying and creating three dimensional objects on a two dimensional screen. One method is to represent the 3D space with various orthogonal views on the screen, which are face (XY view), top, (XZ view) and side (ZY view). These views always show the appropriate co-ordinate axis to help you orient yourself. Cinema4D follows the convention that the X axis runs towards the right, the Y axis towards the top and the Z axis towards the back, away from you.

You can change the views or move the workspace with the mouse at any time whilst you are working.

☞ Start Cinema4D.

The interface will appear with the main toolbar and an empty document window drawn in perspective.

☞ Choose the “Torus” item from the “Objects/Primitives” menu.

You will see a torus drawn in perspective in the 3D view.



☞ Click on the “XZ” button in the main toolbar.

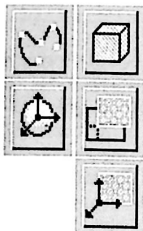
The torus will be shown in the Top view, so called because the torus will be displayed as seen from above.

- Click wherever you like in this window and holding the left mouse button down, move the mouse and observe what happens to the workspace.

As long as you hold the mouse button down, the workspace, torus, co-ordinate axes and grid will all move with your mouse movements. To speed things up, your torus is represented by a bounding box. As soon as you let go of the mouse the workspace stops moving and everything is redrawn.



The action you just performed with the mouse worked because the “Work with view” and “Move” buttons in the main toolbar were activated.



The top six buttons determine which part of the interface you will be controlling, in this case the view. The other five buttons are used for altering the points on an object, the object itself, the object axes, textures and an objects texture axes.

Now have a look at the next four buttons. This is where you choose the action you want to perform. While the move arrow is activated, you can move the view with the mouse. If you want to enlarge the view, use the “Scale” button to the right of the “Move” button.



- Click on the “Scale” button, put the mouse somewhere in the document window and move the mouse around whilst holding down the left button.

You will see that the display gets larger or smaller depending on whether you move the mouse to the right or left. You may find that you have problems manipulating an object in the face, top or side view. If this is the case, you can work in the 3D view. This view displays the objects in perspective; as if seen through an imaginary camera. Needless to say, objects that are closer to the camera will be drawn larger than those further away.



- Change to the “3D” view by clicking on the “3D” button.

You will now see the view from the camera, this should be displaying the white torus in perspective. To help you orientate yourself, Cinema4D draws a grid over the XZ plane.



- ☞ Now click the “Rotate” button and move the mouse around with the left button down.

This time you will be moving the editor camera around the torus in real-time. You should find that moving the mouse in a left or right motion will rotate the camera horizontally, while an up and down movement will move the camera above or below the torus.



- ☞ Try the “Move” and “Scale” buttons too.

As you can see, Cinema4D allows you to move the camera freely around the scene.

With the “Move” button activated, hold the left mouse button down and move the mouse. You will find that the camera moves along the X axis with a left/right motion, and along the Y axis with an up/down motion. If you swap between mouse buttons and hold down the right one, you will find that a left/right movement will move the camera along the Z axis (forwards and backwards).

- ☞ Try altering the camera view using both the left and right mouse buttons in conjunction with the move and scale buttons.

Next to the three projection buttons (XY, ZY and XZ) and editor camera button (3D), you will find a button that lets you display all the views at once.



- ☞ Click the “4T” button.

All four views will be displayed at the same time in the document window.

- ☞ Activate the “Move” button and click the mouse in the top left hand quadrant of the document window (the 3D view). Just as before, you will find that you can move the editor camera with the mouse button held down.

As you can see, although you are changing the camera view, the other three views remain unchanged.

- ☞ Click in one of the other quadrants and try moving the mouse as before.

You will see that now the camera view (3D view) doesn't change, but all the two-dimensional views do.

The 4T display is extremely useful for giving a good overview of your object and scene. However, it does have the problem that objects cannot be edited easily since each view is only a quarter of the full size. The 4T view is also slower to update due to the fact that with four views, Cinema4D has to draw each object four times.

You should now have an idea as to how the interface works. However, there are another series of very useful functions that you should also get to grips with.

First up is the magnifying glass. This tool allows you to enlarge, or reduce, a particular aspect or view.

- ☞ Go to the 3D view.



- ☞ Click on the "Magnifying glass" button and hold the mouse button down. A pop-up menu will appear with various options. Incidentally, a small black triangle in the bottom-right corner of an icon indicates a pop-up menu.

Choose the "Magnifying Glass" option. The mouse pointer will instantly change into a crosshair. Press and hold the left mouse button down over the torus. Now move the mouse. You will see that Cinema4D allows you to draw a frame. Draw the frame over the middle of the torus and let go of the mouse button.

Cinema4D immediately redraws the work area with the view set to the area over which your box was drawn (i.e. the middle of the torus).

Now that you've looked at the torus enlarged, we should now make it completely visible again.

- ☞ Click on the "Magnifying Glass" button again and choose the "Active Object" option.

This causes Cinema4D to fit just the selected object into the window - in our case, the torus. If you choose the “Whole Scene” option, Cinema4D changes the view such that every object in the scene is visible.

One of the particularly useful function within Cinema4D are the grid lines shown on the screen. These can be used to both orient yourself, and position objects in the 3D world. The grid options - along with many other aids - can be found in the “Information” window. This window has several pages containing information on the position of objects and the camera.

 Open the “Information” window by choosing the “Window/Information” menu item. When this window is open there will be a tick by its name in the menu.

In the bottom right corner of the “Information” window you will find a cycle gadget labelled “Info”, this is used to choose the page you want to view.

 Select the “View” page.

This page shows the position and attitude of the camera, along with the preferences for the various grid styles.

The view page allows you to set whether you want to see grid lines (the ones visible on the screen), as well as how far apart they should be. You will also see that the view page shows three other grid systems. Unlike the “Display” grid, the “Move grid”, “Scale grid” and “Rotate grid” can’t be viewed on screen. These grids are used for the snapping, scaling and rotating of objects with respect to the grid system. A tick next to any of the grid systems indicates that the function is active, whilst a value to the right of the grid system shows its current setting.

Of course, you don’t just have the ability to look at these values and parameters, you can also change them. Simply click on the value you wish to change, and change it using the keyboard.



- ☞ Go to the XY view.
- ☞ Click on the display grid value and change it to 50, then hit the return key. You will see that the display grid will immediately change.

Incidentally, if you zoom out too far, or set the grid value too small, the grid will disappear. This is due to the fact that the lines would become too dense to display accurately.

- ☞ Set the value for the Move grid to 5 and the display grid to 100 so that you can work through the next section.

3. Working with Objects

It is not always easy for new users to create new objects from scratch. Cinema4D therefore comes equipped with a series of basic objects (primitives) which can be used to build more complex objects - just like building blocks.

In the “Object/Primitives” menu you will find an alphabetical list of objects such as cube, plane, pyramid, square, triangle, and tetrahedron.

To create a primitive, simply select the appropriate item from the menu. This object will be displayed in the centre of the visible workspace using the preset values. Should you want to alter the preset values, select the primitive while holding the shift key down.

You can also create a primitive from the object toolbar. To open the toolbar, select the object toolbar entry from the Window menu.



- ☞ Choose the menu item “Object Toolbar” and click the mouse on the “Primitives” button.

A pop-up menu appears with the same entries as those found on the Objects/Primitives menu.

A short description of the most important primitives follows:

Cone	You can create a cone with or without a base by clicking on the “Base” gadget. You can also set the radius, height of the cone, and how many subdivisions it has.
Cube	The cube is built from six squares. You can set the edge length for the cube, and whether the faces making up the sides of the cube should be created as separate objects.
Cylinder	The radius and length of the cylinder can be set. The cylinder sides use squares and you set their number in the subdivision field. In addition, if you don’t want the cylinder to be hollow, you can put ends on it by clicking on the “Ends” gadget.
Plane	The plane consists of a number of squares combined to form a large square. It always appears parallel to the global XZ plane and is, above all, for later use with the “Crunch” or “Deform” tools. You can set its width, length and the number of subdivisions.
Pyramid	You can set the height and ground edge length. This makes a four-sided pyramid.
Rectangle	You can set the height and width of the rectangle. The rectangle always appears parallel to the global XY plane.
Sphere	The sphere has an important peculiarity. Namely that you can create either a standard sphere composed of triangles and squares, or a genuine, mathematically perfect, sphere. The difference can be principally seen when the spheres are later rendered. The perfect sphere always looks its best when rendered and actually renders very swiftly, whereas the polygon sphere’s outline edges can be seen. However, only the polygon sphere can be used with functions like “Crunch”, “Deform” or “Subdivide”. Perfect spheres are represented in the display by their contours.
Tetrahedron	This object is made from four identical triangles. You can set the edge length for the triangles.
Torus	You can set the radius of the ring and the tube along with the torus’ subdivisions. The torus is always made from squares.
Triangle	You can set the height and width of the triangle. The triangle is right-angled and always appears parallel to the global XY plane.

As a rule, the greater the number of subdivisions, the better the rendered object will look. A greater number of subdivisions does however take more time to render and can require considerably more memory.

 Try out the different primitives.

For any scene to appear realistic, you need a background. This shouldn't just be an immovable picture (although Cinema4D can do this too), but a convincing and impressive one as seen from the camera's location. Cinema4D gives you the "Ground" function, this is laid, endlessly, across the XZ plane. To prevent the screen from becoming too cluttered, the Ground object can only be seen when using the perspective view.

To match the Ground, Cinema4D also has the "Sky". This is an infinitely expandable sphere which curves over the Ground. In the same way as the Ground, the Sky can only be seen in the perspective view.

 Choose the "Ground" and "Sky" functions from the Object menu. This will also activate a tick in front of their names in the Object menu.

The Ground and Sky are different to other objects and therefore have their own set of rules. The principal rules being that because they have infinite size, they cannot be moved or scaled.

Cinema4D's text function is ideal for producing professional video titles. The text function allows you to enter any amount of text, which Cinema4D will then convert into 3D text in the editor window.



 Choose the "Text" function from the "Objects/Special Objects" menu.

Cinema4D opens a window which contains fields for the text, font, and font attribute settings.

 Enter "Cinema4D" into the text field and hit OK.

Cinema4D now loads the required letters from the hard drive and draws them in the workspace. Once the various objects have been created, it is time to learn how to store your work.

☞ Select the “Save As...” function from the Project menu.

This brings up the Amiga’s standard file requester, input the path and filename to be used.

☞ Enter “Test” into the “File” text field and hit OK.

Another window will open with ticks in it. We’re not too interested in this at the moment so simply click OK again.

Your scene is now saved under the name “Test”. To prove this we will close the document window.

☞ Click on the document window’s close gadget.

☞ Call the “Open...” function the Project menu.

This will bring up a file requester.

☞ Choose the saved file “Test” and click OK.

A document window will open with scene that you saved.

☞ If you now change the scene in some fashion. For example, insert a pair of objects.

Once you have made the alteration, we will now re-save the scene. Rather than using the rather cumbersome “Save As...” function, simply choose the “Save” function from the same menu. The scene will then be immediately saved, without any questions, under the same name. Incidentally, the filename is always shown in the document window’s title bar. It is also worth noting that any document that is new and unsaved, has the name “Untitled” shown in its title bar.

It is worth getting into the habit of regularly saving your work, roughly every half an hour or so. Thus in the unlikely event of power failure or systems crash, you will only have lost, at most, half an hours work.

4. Three Choices

As you have probably already noticed, each new object you insert is drawn in white, while all other objects are drawn in light grey. Cinema4D does this to distinguish between active objects (drawn in white) and inactive ones (drawn in light grey). This is important because many function, such as those on the tool menu, only work on the currently active object.

There are several ways of activating an inactive object:

The simplest is to click on the object's black dot. This serves as the origin point for the object's co-ordinate system and, at the same time, gives you something to select an object with. Upon clicking an objects origin, the object will immediately turn white to indicate that it is active.

☞ Close the document and choose "New" from the Project menu. Switch to the XY view and create the word "Activate" with the text function.

☞ Try activating the letters of the word by clicking on the black dots one after the other.

Another way of activating objects is via the "Select Object" function:

☞ Activate the letter "e" and call up the "Select Object" function from the Edit menu.

This function allows you to select an object by its name. It displays a list of all the objects in a scene in alphabetical order. You can see that each letter of the text you have just created lies under the object with the title "Activate".



☞ Double click on the letter "e".

By doing this, you will reach - just like the Amiga operating system - a deeper hierarchy level (drawer) and you will be able to now see the sub-objects.

☞ Click on the “Parent” button. You will find yourself back in the parent level. Click on the “Parent” button again and you will now see the group object “Activate”.

☞ Click once on “Activate” and close the window by hitting OK.

The group object “Activate” will now be selected.

☞ Switch to the 3D view and create a cone.

☞ Open the “Select Object” window again. As you can see, the cone (with its polygons) also has sub-objects; in this case the object “base” for the base polygons. You can now set the option “With sub-objects” to determine whether the cone object and all its sub-objects, or only the cone itself, without any sub-objects, is selected and activated.

☞ First of all, select the “Cone” object and leave the “with sub-objects” turned on, close the window by clicking OK.

Nothing happens because no changes have been made.

☞ Call up the “Select object” window once more and deactivate the “with sub-objects” button, close the window by hitting OK.

You will see that this time only the cone, without its base, is activated. The base will be drawn in light grey.

You can also differentiate between selecting the object with and without sub-objects in the work window. Clicking on an object with the left mouse button will select the object with all its sub-objects, whereas clicking on it with the right mouse button will select only the object itself, without any of its sub-objects.

Finally, there is a third way of activating objects.

☞ Choose the letter “e” again.

☞ Hit the right cursor key a few times.

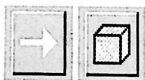
You will see that the letter objects will be activated one after the other. With the left and right cursor keys you can select objects on the same hierarchy level. With the up and down cursor keys you can move between hierarchy levels. Play around with the cursor keys!

5. The Toolbar

Now that we have tried making some different objects, we are now going to try changing them. Up until now, we have stuck mainly to working in the centre of the window.

☞ First, close the current document and create a new one.

☞ Create a torus.



☞ Click on the “Move” and “Edit Objects” gadgets in the main toolbar.

☞ Click and move the left mouse button anywhere (apart from where there are the black dots of object sources) in the document window.

While you are moving it, the torus will be replaced by a bounding box for reasons of speed. As soon as you let go of the mouse button, the torus will be redrawn at its new location.

It's just as simple to re-size the torus.



☞ Click on the “Scale” button. Now when you click on the left mouse button and move it, the position of the torus remains static but its size will now change.

It's the same for rotating an object. Here you must first set which axis you wish to rotate your object about. To set this, there are three buttons in the toolbar labelled “X”, “Y”, and “Z”. These represent the X, Y and Z axes. The selected button is the axis about which your object is rotated.



- ☞ Click on the “Rotate” button and then the “Y” button. Now when you click the left mouse button and move it, the object will be rotated about the Y axis.

You have just learnt how to position individual objects and change their size and attitude.

6. The Perspective Display

Now we come to a new subject, the rendering of realistic pictures with effects such as light, colour and shadows.

Cinema4D includes six different rendering algorithms. The simplest, and fastest, is “Wireframe”. This algorithm produces an output which is similar to the one that you can see in the editors “3D” view. Wireframe only draws the faces of objects as lines, so you can see straight through every face. Upon running the algorithm, Cinema4D will open a new window onto which you picture will be rendered.

Cinema4D uses the perspective camera as the view that is rendered. This camera is completely independent of the editor camera; this has the advantage that you can move the editor camera, without losing the view that you have setup in the perspective camera. The view in the perspective camera is set using the same method as that used to set the editor camera view, except, you must have the perspective mode icon selected in the main toolbar.



- ☞ Close all current documents and open a new one with a torus in the middle. Switch to “Perspective” view mode. Select the “Scale” gadget from the main toolbar and zoom the camera in; make the torus fill the display.



- ☞ Select the Wireframe option from the pop-up menu on the “Render” gadget.

A new screen will immediately appear, with the torus drawn in the same perspective as in the “Perspective” view.

‘You would not be wrong for thinking that this picture look very similar to the one you were previously looking at in the editor.

- ☞ Click anywhere in the picture with the left mouse button to return to the editor.

Cinema4D will be showing the “Progress” window, this displays the percentage of the picture that has been rendered. Since the torus wasn’t very complicated, the rendering process was extremely quick and the bar shows 100%. As you will see in the following section, rendering times aren’t always quite so swift. When this is the case, you will find the render progress bar invaluable.

At any time, including during rendering, you can switch between the picture being rendered and the Cinema4D screen with the “Progress” window. To do this, click on the “Show picture” button in the progress window and you will see the rendered picture.

- ☞ Click on the “Show picture” button.

You will see the torus as before.

- ☞ Click anywhere in the picture.

You will see the “Progress” window, as before.

- ☞ Cancel the whole operation by clicking on the “Cancel” button.

The screen with the torus and the progress window will both close and you will be returned to the main interface.

Wireframe is certainly the fastest render algorithm, although it doesn’t always give a very good representation of an object. Removing hidden lines and faces improves the depth perception enormously. For this reason, shaded rendering was developed early on in the history of computer graphics. Using this method, the faces that are furthest away from the viewpoint are drawn first, followed by the faces closer to you.



☞ Call up the “Shaded” option from the pop-up menu on the Render button.

This time a new screen isn’t immediately opened, instead, the progress window appears. At this point, Cinema4D calculates the depth of all the faces in your objects as well as how it should sort them. Depending on the speed of your computer, a new screen will appear shortly, on which the shaded torus is drawn.

In contrast to “Wireframe” mode, the hidden faces are now overwritten by the visible ones. These faces are coloured in different shades of grey. This is because Cinema4D has several accepted standards to make life considerably easier. One of these is the standard material. As long as you don’t assign a material to an object, it will use the standard material. Another preset is the automatic light source. If you haven’t defined a light source in your scene, Cinema4D will automatically put one at the camera’s position for rendering.

So far, we’ve looked at edged, faceted pictures that only have one colour per face.

One disadvantage of shaded rendering is the fact that, occasionally, errors can creep into the picture. This can happen when Cinema4D is unable to decide the difference between two polygons which intersect each other. In this situation, Cinema4D has problems determining which of the two should be drawn first.

A further step up in picture quality is possible with the “Scanline” algorithm.

In contrast to “Shaded” rendering, where every single face is sorted depending on its distance from the camera, the Scanline algorithm checks out every point on each individual face. The layering problems we’ve talked about are a thing of the past. In addition, the Scanline algorithm checks the brightness for each visible point on a face, so that the face can be coloured correctly. Naturally, this requires much more rendering, so the Scanline algorithm takes considerably more time than the “Shaded” algorithm.



- ☞ Call the “Scanline” function from the pop-up menu on the “Render” button.

As we have seen before, the Progress window appears. At this point, Cinema4D performs numerous calculation; the time taken for which is entirely dependant on the speed of your computer. When the picture does appear, you will notice that the torus’ appearance is no longer faceted, but round and smooth.

For the best picture quality you can use the Ray-tracer. In addition to the Scanline algorithm, the Ray-tracer will also generate realistic effects such as shadows and transparency. Before trying the Ray-tracer, we would recommend that you familiarise yourself with the next section, as this will show how to assign different colours and materials, such as transparency, to an object.

7. Materials

Cinema4D allows materials to be created, saved and altered independently of objects. Objects within Cinema4D will only use materials that have been assigned to them, so, if you don’t give an object a material, it may not be visible when rendered.

- ☞ Choose all the objects in your scene with the “All” item in the Edit/Select menu, then select the “Delete” item from the same menu.

- ☞ Call up the “Materials Manager” item in the Edit menu.

This opens a window that, on the left-hand side, bears a striking resemblance to the “Select Object” window we’ve already taken a look at. This list of choices is empty to start with, apart from the so-called “Standard” material.

You can make a new material yourself by clicking on the “New” button. This is very easy to do, but you can always fall back on the provided materials.

- ☞ Click on “Load”.

A file requester will appear. The path is preset to appear in the materials drawer on your hard disk.

☞ Load the “Red Plastic” file.

This material now appears in the list.

☞ Repeat the process to load the “Green Plastic” and “Blue Plastic” files.

As soon as you have inserted these three materials, you will need an object to apply them to.

☞ Close the Materials Manager window by clicking on its close gadget. Then create a cube, sphere and a torus. Move these three objects around in the “Perspective” view so that the cube is on the left, the sphere is in the middle and the torus is on the right.

☞ Activate the cube.

☞ Call up the “Select Material” function from the Edit menu.

This will open a list of all available materials, only without the display and edit options.

☞ Select the “Blue Plastic” material and hit the OK button.

☞ Now open the “Information” window and go to the “Parameter” page.

The name of the material applied to the active object is shown here.

☞ Give the sphere the “Red Plastic” material and the torus the “Green Plastic” material.

You should have noticed that despite applying materials to each object, the objects still look the same in the editor. Materials and colours can only be viewed when the scene is rendered.

☞ Start a Scanline render.

You should see a blue cube, a red sphere and a green torus with varying shades of colour and highlights.

- ☞ Insert the material “Grid” into the material list. Apply it to the sphere and start the Scanline algorithm again.

The sphere no longer looks like it is made of red plastic, but as though it has been overlaid with a grid. As you can see, pictures can be used as textures then placed on objects. Should you want to, you could create materials with textures yourself, the process for doing this is covered in a later chapter. For now, we will fall back on the materials that come with Cinema4D.

- ☞ Add the “Green Glass” and “Checks” materials to the materials list and give the torus the “Green Glass” material.



- ☞ Activate the “Ground” from the Object menu. Make it the active object by using the “Select Object” function and give it the “Checks” material.

- ☞ Move all the objects so that they lie above the XZ plane (this is easiest in the XY view). This will stop the Ground from cutting the objects in half or lying on top of them.

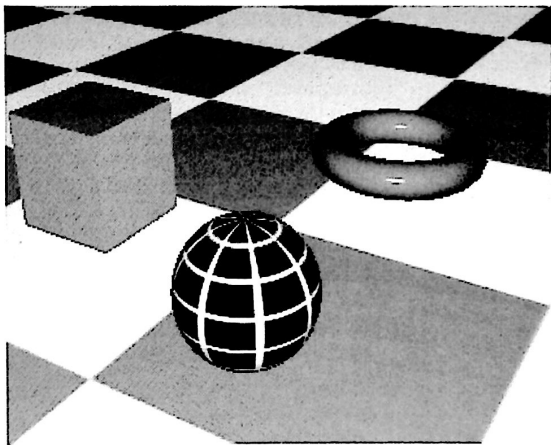
You should now have a chequered Ground, a see-through torus, a blue cube and a grid-covered sphere.

- ☞ Start the Scanline algorithm.

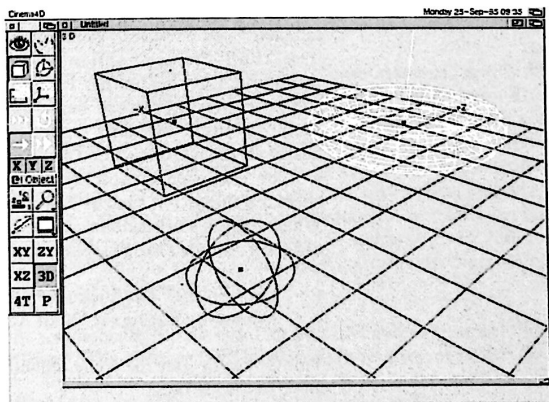
Because the Scanline algorithm cannot show shadows and transparency, the torus isn't see-through.

For transparency to show, you need to use the ray-tracer. The ray-tracer is actually independent from the Cinema4D editor, and before it can run, Cinema4D needs to create a temporary file that contains all the necessary information about the scene it is about to render. This file needs to contain the location of all the scenes textures, and backdrops etc.

- ☞ Start the ray-tracer.



Picture 1



Picture 2

When the ray-tracer has finished rendering the scene, you will see that the torus is now transparent.

If you have any problems, you can always fallback on the provided scene “Tutorial.1” which includes everything we have covered so far (picture 2).

Up until now, the Scanline and ray-tracer algorithms have only been used to generate quarter-screen images, you could however set any size you like. Altering the image size can have drastic effects on the time taken to render a picture. For example in a 160*128 pixel image (the default), Cinema4D has to calculate the colour and layering of roughly 20000 points. In a 80*64 pixel image, Cinema4D only has to calculate 5000 pixels - making the render approximately four times faster.



☞ Call up the “Ray-trace” function on the Render button’s pop-up menu while holding down the shift key.

Next to the many switchable options, are numeric fields into which you can enter the resolution to which you would like the picture rendered. You can enter any resolution you like.

Instead of entering the resolutions by hand, Cinema4D offers you some preset resolutions. There are three buttons for this labelled “Test Picture”, “Medium Picture” and “Full Picture”. The “Full Picture” option will render a picture at full resolution. Clicking on the “Half Picture” button will result in a quarter-screen picture being rendered, while the “Test Picture” button will only render a tiny picture. In addition, nearly all the options will be de-selected so that the test picture will be rendered as quickly as possible. This is ideal for checking things out such as how a material looks on an object. When you are working on a scene, always use this mode so you can see a rendered image as soon as possible.

☞ Click on the “Test Picture” button and close the Ray-trace window by hitting the “Start Rendering” button.

This will both start the scene rendering, and store any changes made to the settings.

In a short time you will once more see the scene with the cube, sphere and torus, but this time it will be much smaller. The torus won't however be transparent because when you hit the "Test Picture" button, the "Transparency" option was de-selected.

☞ If you want to, you can now render the scene at full resolution with the ray-tracer.

8. Working with Hierarchies

☞ Create a new document containing a cone.

☞ Choose the "Object Manager" item from the Edit menu.

You will now see a window containing two lists which includes all the names of previously created objects.

You have already learnt the first difference between activating objects and sub-objects in the "Select Object" window. We will now detail how objects can be arranged hierarchically.

Depending upon the current window font size, you may also get icons appearing next to each object. cf. Menu Function Reference 2.6.

The principle behind Cinema4D's "Object Manager" tool is the idea of uniting groups of objects as a single object group. This gives you a clearer overview of objects, as well as allowing you to perform actions on more than one object at the same time. This mirrors the same way the Amiga operating system works. For example, to move or copy complete directories, you don't need to repeat the same action on each file but only on the single directory. In a similar way, Cinema4D gives you the option of uniting objects into object groups or even object groups into a larger object group!

At the moment, the list contains only the names "Camera" and "Cone". The "Perspective" camera is always present in this list.

☞ Choose the "Cone" by double clicking on it.

This will now show the contents of the Cone object group. Here you will find the sub-object "Base".

☞ Click on the “Parent” button under the left list.

You will find yourself a hierarchy level higher.

☞ Click once on the name “Cone” and then on “Duplicate”.

The name “Cone.1” will now be added to the list.

☞ Click once on the name “Cone”. Go to the text field under the left list and change the name to “Cone.2”. Leave the text field by hitting the <RETURN> key.

You should now see the two names “Cone.1” and “Cone.2” in the list.

Next we’re going to create a new object group for the two cones.

☞ Click on the “Axis” button (an axis is an empty object group with no points or faces). A new object appears with the name “Axis”.

☞ Change its name from “Axis” to “Two cones”.

☞ Move your mouse to the name “Two cones” and double click on it.

The left list will now display the contents of “Two cones”. As it contains nothing at the moment, the list is empty. Meanwhile the right-hand list remains unchanged showing the original list.

☞ Leave the object group by clicking on the “Parent” button. Now the same list is displayed in both panels. We now want to put the “Cone.1” and “Cone.2” objects into the “Two cones” directory”.

☞ Move your mouse to the name “Two cones” in the right-hand list and double click on it. Once more it shows an empty list.

☞ Choose “Cone.1” from the left-hand list.

☞ Click on the “Move” button.

You will see the “Cone.1” object move into the right-hand list. It is now in the “Two cones” object group.

☞ Repeat the process for the “Cone.2” object.

Now both cones should be in the “Two cones” directory. You can easily check this:

☞ Double click on the “Two cones” name in the left-hand list. You should immediately see its contents, namely “Cone.1” and “Cone.2”, the same as in the right-hand list.

Let’s summarise once more:

- ☞ A double click on an object group puts you inside it.
- ☞ A click on the “Parent” button will take you back out of that object group.
- ☞ You can move an object from one list to the other by clicking on the “Move” button.
- ☞ You can change the name of a selected object by altering the name in the text field.
- ☞ You can create a new object group by clicking on the “Axis” button.
- ☞ You can duplicate an object by clicking on the “Duplicate” button.

The “Object Manager” window offers other useful functions, including the option to save an object to your hard drive for use in another scene. Using the “Save” button you can build up your own library of objects. For instance, if you’ve created a library containing a stool, table and cupboard, you could insert them, as required, into any scene.

☞ Click on the “Save” gadget to save the “Two cones” object.

The familiar file requester appears.

Enter the path name where you want to save the object, and then type a descriptive name for the file, "Two_cones" would probably be the best idea, then hit OK.

Close the "Object Manager" window by hitting the window's close gadget.

You will only see one cone in the document window because they are lying one on top of another.

Use the "Select Object" function from the Edit menu and choose the object "Cone.2". Move this object to somewhere else in the workspace.

Use the "Select Object" tool to select the "Two cones" object and then move that around.

You can now see the advantage of a hierarchy; more than one object can be operated at any one time.

9. The Clipboard

What happens when you've spent all morning trying to build a wheel for a car, only to realise that you need four of them. Well, Cinema4D has a function that is similar to the "Duplicate" function found in the "Object Manager" window called the clipboard. Put simply, the clipboard is a section of memory used by Cinema4D to store any item (e.g. objects, light sources, polygons etc.) temporarily.

The function that is most often used is the "Copy" command from the Edit menu. This places a copy of the currently active object on the clipboard. The copy isn't actually visible anywhere but it has been stored in the clipboard. If you want to call up this copy, select the "Paste" item from the Edit menu. An identical object is immediately placed in the same position as the previous object - even if you had deleted the original object. Using the "Paste" function you can make any number of new copies of an object.

Create a cube in a new document.

☞ Call up the “Copy” and “Paste” functions from the Edit menu, one after the other. The old cube will be deactivated and a new, activated cube will be immediately drawn over the top of it.

☞ Move the new object somewhere else so that the old object becomes visible once more.

A copied object will only stay in the clipboard until another object is copied or cut. The new object will then overwrite the old one!

A slight variation on the “Copy” function is the “Cut” function. This basically works in the same way as described above, with the difference being that once the object has been copied, it is then deleted. You can use this function to get rid of objects with the added security that the object isn’t truly destroyed but is stored in the clipboard and is retrievable at any time.

If you actually want to delete an object, without it going to the clipboard, use the “Delete” function from the Edit menu. The active object will be deleted from the workspace and memory. Choosing “Paste” won’t help because the object wasn’t copied before it was deleted.

You can also delete an object simply by hitting the or <Backspace> key.

10. Undo

Should you make a mistake in any editing, Cinema4D has a very useful “Undo” function. Using the “Undo” function from the Edit menu, you can undo your last action. For example, if you deleted an object accidentally, you can use the “Undo” function to bring the object back to its previous state. “Undo” doesn’t help however with functions that change the editor interface or enlarge the visible section.

☞ Create a torus.

☞ Choose the “Crunch” function from the Tools menu. This randomly Crunches your object.

☞ Choose the “Undo” function from the Edit menu.

You will once again see your smooth, original torus.

- ☞ You can redo an undo by selecting the undo function again. Select undo and the Crunched torus will reappear.
- ☞ Calling the “Undo” function once more will redisplay the smooth torus. You can do this as often as you like.

11. Material Design

Once you have familiarised yourself with material library supplied with Cinema4D, as well as how to how to render a scene, it's time to set up some new materials.

- ☞ Close all open documents and create a new one. Create a sphere and position the camera in the perspective view so that the sphere fills the centre of the screen.
- ☞ Select the “Materials Manager” function.
- ☞ Click on the “New” button to create a new material.

To the right of the material list, you will see various controls to allow you to alter your material. As you can see, radio buttons are present for each of the material attributes, such as colour, transparency, relief etc. Upon selecting an attribute, you can alter its value by moving the various sliders or by entering a value into the active field.

- ☞ First of all, change the name from “New” to “Yellow”.

The most important attribute, colour, is at the top. When the colour button is activated, you can change the hue using the three sliders. You should play around with these sliders to get a feel for the different colour settings.

Alternatively you can type in the colour components by hand in the text fields next to each of the sliders.

- ☞ Either using the sliders or numeric input, set the colour values as following: Red 100%, Green 100% and Blue 0%. This will give you yellow.

The materials list will now contain your new yellow material.

☞ Close the window.

☞ Apply the new “Yellow” material to your sphere using the “Select Material” window and have a look at the result of a scanline render. You will see a matt yellow sphere.

Next we will change the material you just created. You could call up the “Materials Manager” window and edit the material in that window. However, it is considerably quicker to just use the “Edit Material” function. Using this will bring up a window in which you can edit the material for the currently active object.

☞ Select the “Edit Material” function.

You will now see the “Edit Material” window.

☞ Enter 40% for the “Shine” attribute and close the window with the OK button. Have another look at your object by rendering it with the Scanline algorithm.

This time your sphere should have a highlight.

You can create a whole host of interesting Materials by just playing around with the many parameters in this window. You can also save materials for later use by clicking on the “Save” or “Save All” gadgets in the “Materials Manager”.

12. Textures

However polished your material settings, you still won’t get the sort of realistic pictures you see in TV adverts. These can only be achieved by putting life into your pictures using textures (bitmaps) on the surfaces of your objects. For example, if you have a picture with the Coca-Cola logo on it, and a long enough cylinder object, in a split second, you can transform them into a Coke can. Or you could wrap a map of the world onto a sphere, voila!, a globe!

As you have already seen, there are parameters for setting the look of an object with colour, transparency, reflectivity etc. These determine the look of all points on a surface. Equally, you could set each individual point on a surface using textures. For example, you could use a paint program to place a white word on a black background. This picture could then be used as a colour texture so that instead of the surface being the same colour all over, it will take the colours from your picture. The result of which is an object that is black all-over except where the word is, which is white.

If you used the picture as a transparency texture, then the darker parts of the picture would be opaque, whilst the lighter areas would be see-through. Thus the areas of the object that have no text on, will be completely opaque, while the area where the word is will be completely transparent. You will even be able to see other objects behind it.

A reflection texture, and its corresponding reflection attribute, work in exactly the same way as the colours in the picture.

There still remains the question of how Cinema4D puts a picture onto a surface. After all, objects made from squares, can be made into anything from a sphere, to a jagged fractal landscape. Therefore, because it is very difficult to apply an exact texture for every surface, Cinema4D makes use of three important projection methods. The simplest is the flat projection, this projects or lays the picture completely flat onto the object, no matter whether the object is flat or round. The flatter the object, the less distorted the projected picture. Flat projections can be thought of like a slide projector. The slide - in our case, our texture - will be thrown onto any shape of object.

If you have an object whose shape is more cylindrical, for example a drink can or a vase, then we recommend that you use the second projection method, the cylindrical projection. This wraps the image once around the object and projects it inwards.

The previously mentioned globe would be created using a spherical projection. This wraps the image in two directions around the object so that it achieves a spherical form which is then projected inwards onto the object.

Right, enough dry theory. Why not try using the various methods yourself to find which one is best.

- ☞ Use the sphere from before and call up the “Materials Manager”.
- ☞ Create a new material with the name “Earth material”.
- ☞ Activate the “Colour” button and click on the gadget to the right of the texture text field.

This opens a file requester.

- ☞ Choose the picture with the name “Earth”, which comes with Cinema4D.

Cinema4D now displays the name and path of the picture in the text field.

- ☞ Click on the show button.

Cinema4D promptly loads the picture and displays it. A map of the world can be seen.

- ☞ Click anywhere in the picture to stop displaying it.

An information window appears in which Cinema4D displays the size of the picture and its colour depth.

You have now set a colour texture for the “Earth material”.

- ☞ Leave the window and apply the new material to the sphere.

We must now tell Cinema4D how to project the texture onto the object.



- ☞ Click on the “Texture” gadget in the main toolbar.

The view changes swiftly. On the sphere you can now see a net of several grid lines. This grid represents the texture. You can change the position of the texture using the “Move” or “Scale” tools.



- ☞ Open the texture toolbar from the Window menu. In it, you will find useful functions for working with textures. Click on the “Flat Projection” button.

You have now informed Cinema4D that you want to project the picture flat onto the sphere.



- ☞ Click on the “Scale” tool in the main toolbar and set the size of the picture to roughly one quarter the X length and half the Y length of its original size.

This has reduced the size of the texture. You can now see that the texture shown by the fine grid has shrunk, whereas the original limits have remained the same.



- ☞ Click on the “Move” button in the main toolbar. Position your texture, in the same way as objects, using the mouse. You can also de-select the “X” or “Y” gadgets so that you can only move the texture in one of the two axes. The “Z” gadget has no function at the moment because a flat picture has no third dimension. The X position of the texture is changed by moving the mouse left and right, and the Y position by moving the mouse up and down.



- ☞ Click on the “Edit texture axis” button in the main toolbar. You will now be able to move, rotate and scale the texture axis in three dimensions. Give this a go.



- ☞ Click on the “Cylindrical Projection” button in the texture toolbar.

Instead of the flat limits we previously had, there is now a cylinder shaped set of limits displayed which the texture completely fills, as can be seen by the grid lines.

- ☞ Scale down the texture with “Scale”, making sure that you have selected the “Edit texture” button first.
- ☞ Activate the “X” gadget and de-select the “Y” and “Z” gadgets.
- ☞ Now click on the “Move” gadget and move the mouse around while holding the left mouse button down.

You can see that the texture moves around the cylinder without the cylinder itself moving.

Let's summarise:

You can choose one of three projection methods: Flat, Cylindrical or Spherical. When choosing one of the projection method, you should try and use a method that is best suited to the individual object. In addition, you can set the attitude and even the position for the texture using the texture axis. The fine grid lines show the position where the colour-, transparency-, or reflection-texture will be shown when rendered.

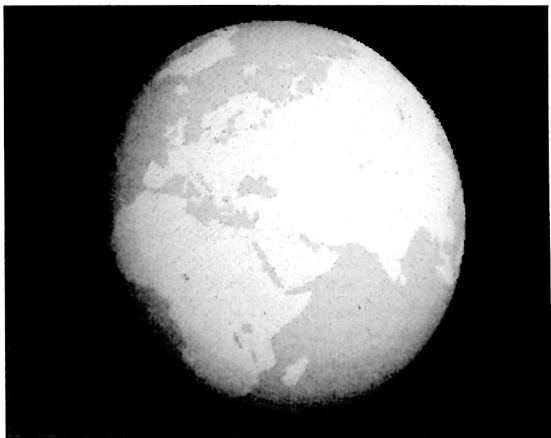


Click on the "Spherical Projection" button.

Now the texture is shown wrapped around a ball.

Do a Scanline render.

If you have done everything right, you should see the sphere with a picture of the earth on it.



When you leave the Scanline algorithm, move the camera to a suitable place you can see the globe from all sides.

- ☞ Set the size of the texture to roughly a quarter of its original size.

The previous full-sized texture now occupies only a small portion of the sphere's surface.

- ☞ Start the Scanline algorithm again.

The sphere will be displayed again, only this time it is covered with multiple textures. The reason for this is due to Cinema4D automatically selecting the "Texture Tile" function in the texture toolbar.

13. Polygons

As well as primitives, you can also create complex forms and objects using polygons.

Polygons are represented by nothing more than a contour which can be rotated in three-dimensional space to create an object, such as a vase. You can also use polygons to place objects, or another polygon, along its path.

Cinema4D includes some preset polygons.



- ☞ First of all, close all documents and open a new one. Select the "Circle" item from the "Object/Polygons" menu.

The outline of a circle will be drawn in the document window. This outline (or polygon) behaves just like a normal face-based object, you can move it, rotate it, or change its size.

- ☞ Now create a "Line" using the item with the same name in the "Object/Polygons" menu.

You will now learn a function which makes the circle's contour run the length of the line, making a cylindrical tube.



- ☞ Call up the “Path Object” function from the “Object/Polygon objects” menu while holding down the shift key.

In the “Path Object” window you can set which polygon should be used as a path, and which polygon is used as a contour to run the length of the path.

- ☞ Click on the “Path” button in this window. A window will appear in which you can choose an object, select the “Line” polygon.

The name of the polygon just selected will appear next to the “Path” button. You must now set which polygon will move along this path.

- ☞ Click on “Contour Select...”.

A window will open containing two lists. The left-hand list shows all available polygons, the right-hand one shows the polygon you have chosen for Cinema4D to use as a contour.

- ☞ Select the “Circle” polygon in the left-hand list and click the “move” button to insert it into the right-hand list.

Leave the window using the OK gadget, and then leave the Path Object window the same way.

Cinema4D now sets the Z axis of the contour along the polygon line of the path, and moves the contour 10 times to make a tube. Move the camera around the newly created object in the “3D” to view the result.

In the Path Object’s window there are, naturally, a range of parameters which can be set. For example, you could raise the number of subdivisions from 10 to 20, which will make a more defined tube, or fit the tube with front and back end plates. These features are covered in more detail in the reference section of the manual.

As we mentioned at the start, you can use polygons to magically generate three dimensional object on the screen. This is done using a polygon as a contour, the polygon is then spun about an axis in space to produce a 3D object. You can try this out for yourself by using the “VaseContour” file in the “scenes” directory.

- ☞ Close all open documents and open the “VaseContour” polygon.

You will see a rather unappealing contour in the XY plane.



- ☞ Call the “Lathed Object” function, while holding down the shift key, from the “Object/Polygon Objects” menu.

This function spins polygons (contours) about their Y axis.

You can enter which polygon you want to use as a contour in this window, how many degrees the contour should be spun about, and how many steps should be used.

- ☞ Click on “Contour Select...”.

As before you will see a window with two lists.

- ☞ Select the name “VaseContour” in the left-hand list and click the “Move” button.
- ☞ Type the value 100 into the “Subdivision” text field and close the window with OK.
- ☞ Close the “Lathed Object” window by clicking on OK.

As if by magic, Cinema4D produces a stunning three dimensional vase. For the best view of it, switch to the 3D display, you will be able to see what a beautifully-shaped object you have just created.

Using this method, you can create any number of rotationally symmetrical objects with ease. You may have noticed that the “Lathed Object” window has a number of configuration options for you to alter the spun objects. For more information on these functions, you should consult the reference section of the manual where each entry is fully documented.

For the close of this chapter, we are going to learn how to make polygons for our own creations.

- ☞ Open a new document and create a line using “Line” option on the “Object/Polygons” menu. Switch to the “XY” view.



- ☞ Click on the “Edit Points” gadget on the main toolbar.

Cinema4D now draws all the points in the polygon, in the case of the line, it only draws two points. You can move the points, when the “Move” tool is turned on, to wherever you like by grabbing a point with the mouse then dragging it to a new location.

- ☞ Put the mouse pointer on top of one of the two points in the line and hold the left mouse button down. Move the mouse around while holding the mouse button down.

You can see that the point follows your mouse pointer. As soon as you let go of the left mouse button the point is set in its new location.

To add another pair of points is no problem at all, simply click on an area with the <ALT> key held down. The rule for adding points, is that a new point is created when you click between the two support points of the line. If you don’t click between the support points, a point will be added to the end of the line.

If by mistake you have added one point too many, then this isn’t a problem:

- ☞ Click on the offending point so that it is activated and then hit the key. The point will disappear.

Should you want to work with more than one point at a time, you can do so provided you hold down the shift key while selecting each point. You can also choose more than one point at a time by drawing a frame around the desired points using the <CTRL> key.

Let's summarise:

- ☞ Points are activated by clicking on them.
- ☞ You can select more than one point at a time by holding down the shift key.
- ☞ Holding down the <CTRL> key lets you draw a frame which selects all points within the frame.

Various types of polygon styles are available, these can be set from within the "Information" window.

- ☞ Open the "Information" window and go to the "Parameter" page. Find the "Polygon Type" field, and set it to "Cubic".
- ☞ Create a flower-shaped polygon using the "Flower" function from the "Object/Polygons" menu and click on the "Edit View" gadget.
- ☞ Open the "Information" window and select the Parameter page.

The "Polygon type" field shows the current interpolation style (at the moment this should be "Cubic").

- ☞ Change this from "Cubic" to "Linear".

The flower instantly changes shape into an object that looks more like an asterisk than a flower.

Polygons allow any form imaginable to be created provided you have the correct support points and you are using an appropriate interpolation styles.

And so we have come to the end of the first tutorial. Hopefully you have gained an insight into some of the more important functions in Cinema4D. Now you should try the animation tutorial.

Animation Tutorial

Cinema4D provides a superb range tools for an infinite number of animation possibilities. The program covers practically all aspects of computer animation, from keyframe animation to path animation, hierarchical animation, inverse kinematics, material animation, light animation and special effects such as explosions, etc. These are fully implemented with simple, but powerful, tools so that you can produce complex animations with ease.

The biggest function range of the animation section is normally hidden so that the user is not troubled with it unnecessarily. Cinema4D pre-defines many of the settings with intelligent defaults. Should you need to, you have access to all animation parameters to give your finished animation the polished look.

Unlike the other section in the manual, this section does not handle the Cinema4D functions in a linear manner; animation styles are discussed through the process of building an animation rather than simply providing you with the functions. The reason for this is due to the added complexity of having to think in another dimension - time.

1. Tempus Fugit

Animation is basically a series of different events, such as a change in motion or materials, which appear at different points in time and stay for a predetermined duration. Therefore it is essential to have a suitably simple measuring system for the setting and co-ordination of each transition point in time.

Many editors use a frame-based system for the sake of simplicity. If, for example, you have a cine film running at 18 frames per second, then each second consists of 18 frames. Therefore for a computer animation that you wish to output at 18 frames a second, you must render 18 frames for each second of the finished animation.

Thus, for 1 minute of film at 18 frames per second, you would require a total of 1080 frames. With the finished picture (or frames) being numbered sequentially i.e. the first being given 0 and the last 1079. With this system, all events are defined via a picture number. Thus, a pre-determined motion could occur between pictures 1037 and 1045.

It's not difficult to see that this method isn't very convenient. If the user wanted to make a change in speed from 18 frames per second to 24 frames per second, you would have to change all the picture numbers. A more natural measurement would be minutes and seconds. This makes setting transitions much easier than trying to calculate the frame value that a transition should start and stop at. In a similar vein, Cinema4D allows you to measure distances in metric values rather than pixels.

Nevertheless, you can use either method in Cinema4D and you can set which of the two standards you prefer in the editor preferences.

If using frame numbering, you must remember to enter the letter "F" (e.g. 1039F), at the end of the frame number. This informs Cinema4D that you wish to use frame numbers as opposed to a time value.

When you are entering a time, you must use the designated notation. The first number is the number of minutes, the second is the number of seconds, and the last value is the number of frames from the start of the second. The following example should clear things up:

Let's stay with 18 frames a second. The time "0:20:06" therefore means that we are at a point in time of 20 seconds and six pictures (or 6/18ths of a second) in.

If we switch the rate to 24 frames per second, then the same point in time "0:20:06" will mean 20 seconds and 6 pictures (or 6/24ths or a 1/4 of a second) in.

If you enter a value without a measuring system (time or frames), then Cinema4D automatically chooses a value based on the system selected in the preferences. For instance, a value of 12 means the 12th frame if you are using “Frames” as your animation system. If you are using “Time” as your animation system, then 12 means the 12th second.

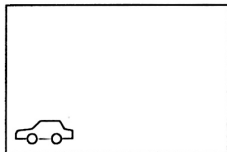
2. Construction Principles

Cinema4D’s animation system has its own systems of units of differing size and importance. These provide both flexibility and structuring, to give greater control over your animation.

The smallest unit is the Key. The key marks a single point in an animation, where a particular action begins or ends. As an example, let us define the first position for a car. It should lie in the bottom left-hand corner of the screen at 0 seconds.

Cinema4D begins counting frames at 0. These have an effect in the time notation.

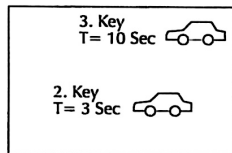
If you have set a frame rate of 15 frames per second for example, then the last picture in the tenth second is not 10:00, but 9:14.



1. Key

T = Sec.

Picture 1



3. Key

T = 10 Sec

2. Key

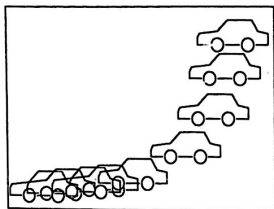
T = 3 Sec

Picture 2

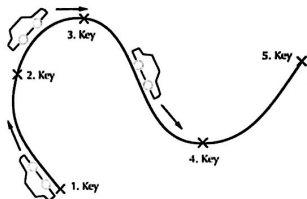
The second and third keys define the position of the car at, say, the 3rd and 10th seconds. The car is now at the top right of the screen.

Cinema4D will use the three keys to interpolate a path between each of them for the finished output.

The car will therefore travel from the bottom left-hand corner of the screen to the top right-hand corner in 10 seconds.



Picture 3



Picture 4

Of course if you want to make a more complex motion path (Picture 4) you would use more than just three keys. You can also choose the interpolation method (linear, cubic, akima, B-spline or jumps) used to generate the path between each of the keys.

Keys don't just get used for position information, they can also set the scale, direction, materials, and many other options. In fact, practically all aspects of an object can be animated using keys.

Adding a key is extremely simple, and can be done at any point by clicking on the "Record" button in the "Time" window. When you hit the record button, the current state of the object (its position, size, direction, material and texture) are saved in the key. A new key can be set whenever you are at a new point in time, with the object in a new position.

What happens, more or less, is that when you freeze certain parts of the film, Cinema4D will automatically fill in the section between the two keys. This style of animation is known as keyframe animation.

Several keys in the same style (e.g. 4 keys with position data or 7 keys with material data) can be summarised as a sequence. With each sequence being characterised by a start and end point of the same type of data. The keys define what happens inside this timespan. A sequence could therefore describe the motion of a foot, or the exploding of car. A sequence can only contain keys of the same type, e.g. position keys or material keys.

The animation of an object is described by one or more sequences. These can be overlapped to allow multiple effects to occur simultaneously. For example, you could set a car in motion whilst changing its colour.

Each object can have more than one sequence, e.g. a position sequence, a material sequence and an effect sequence. The sum of all these is known as the object's track. This is particularly important since tracks are shown in the "Time Line".

3. Frames

You can change the playback speed of the animation you are building at any time. Note that changing from a high frame rate down to a lower one results in rounding down. How else can a 25 frame per second animation be set to 3 frames a second?

Cinema4D allows you to set the time span and frame rate of any animation. The frame rate is particularly important when outputting your finished animation.

Should you want to output the animation as a cine film (with suitable equipment), then you should set the playback rate to 18 frames per second. For film (as in the cinema) it should be set to 24 frames per second. TV would need 25 frames per second for PAL (used in most of Europe) and 30 frames per second for NTSC (used in America and Japan).

You can however set the frame rate to any value you want. When used with a lower picture quality, this facility is ideal for producing a quick preview of your animation.

Just think: If a particular picture needs "just" an hour to render in high quality, and you want to render a 1 minute animation at 25 frames a second, you'll need to leave your computer rendering uninterrupted for more than 60 days!

4. Keyframe Animation

Keyframe animation is not only the most effective, but also the simplest of all the animation types.

 Open the "Time" function from the window menu.

As soon as Cinema4D has finished rendering you can assess the finished animation.

- ☞ Call up the “Play” function from the Keyframe menu. This opens the file requester, so choose one of the rendered pictures, e.g. “T:Test.0000”.

Cinema4D now opens a window in which the rendered frames can be played in real-time. In addition, another window is opened that is similar in appearance to the Time window. This window has similar controls to that of a video recorder, allowing you to play, fast-forward or rewind your animation.

- ☞ Click the “Play” button. The animation will play back. First of all, the cube moves relatively slowly from left to right, and then suddenly shoots up to the top right corner. The reason for this is due to the time gap between keys 1 and 2 being 8 seconds, while the time gap between keys 2 and 3, being just two second.

- ☞ Close the playback window and call the “Edit Sequence” function from the Keyframe menu.

Cinema4D creates a key for the position, size, direction, rotation, material, texture and texture axis of an object when the appropriate gadget is turned on in the “Time” window.

- ☞ Here you can set how the keys should be interpolated for all sequences dealing with “space”. Choose the “Linear” interpolation style for the position sequence, start rendering again and have a look at the end result using the “Play” function again.

You will see that the cube now moves in completely straight lines. You will also see that the linear interpolation causes the cube to make a sharp turn at the second key. Obviously, this is not the best interpolation style when moving objects, however, it is ideal if you are trying to produce hard camera banks. In general, you should stick to the cubic interpolation.

- ☞ Set the “Space” field back to Cubic, but this time also change the “Time” field to cubic.

This time the cube will move very evenly and smoothly from the bottom left to the top right at a constant acceleration.

You have now learnt how to record keys for an object and how to influence the space and time interpolations.

By the way, you will find this example as “Tutorial 3” in the Scenes directory on your hard drive.

Let’s review the main points again:

- ☞ Using the time slider and “Record” button in the “Time” window, you can save the position, size and rotation of the active object as a key.
- ☞ A point in time can be selected by moving the time slider, using time arrows, or by using the “Current Time” function in the Keyframe menu.
- ☞ Several keys together make an animation and are known as a sequence.
- ☞ The type of space and time interpolation is set using the “Edit sequence” function.
- ☞ An animation’s pictures (or frames) are created by using one of the options under the “Render picture” button.
- ☞ These rendered frames can be played back in the “Play” window.

5. Time Line

In the previous chapter we learnt about keyframe animation and how to set objects in motion. We observed the effect keys and sequences have on the animation, as well the effect to objects on screen. We haven’t, as yet, seen the keys and sequences themselves.

Using the example from the previous chapter - a copy named “Tutorial 3” can be found in the scenes directory. Open the “Time Line” window, you will see all the keys and sequences listed for the example.

The “Time Line” window is subdivided into three sections. On the left-hand side you will see the names of the objects in a scene, along with the environment and perspective camera tracks. The central section is filled with bars which are divided up into time segments along the upper edge of the window.

☞ Click on the name “Cube” once with the right mouse button. The field will expand to show other bars.

On the right-hand side you will now see the different types of sequence that can be used to animate your object. Along with the already familiar position, size and direction types, you will find additional types for materials, textures and special effects.

In our example of the keyframe method, we created keys and sequences, these can now be seen.

The Time Line can be compared to a sheet of music. Each key represents a note and each vertical second line represents a bar. Only Cinema4D doesn't play music, but animation.

☞ Use the horizontal slider on the bottom edge of the window to change the displayed segment time.

You will see that the three sequences all stretch from the 0 second mark, to the 10 second mark. You will also notice that at the 0, 8, and 10 second marks, there are small black dots. Each of these dots represent a keyframe point.

☞ Click, with the left mouse button, on the sequence (bar) on the “Position” track. This will activate the sequence prior to editing.

☞ As an example, call up the “Edit Sequence” function. It brings up - just like the keyframe animation - the appropriate window in which you select the interpolation.

☞ Now activate the sequence underneath and select the “Delete” function. Immediately, the size sequence is deleted.

☞ Put the mouse pointer on the “Size” track at the 0 second mark and click once with the left mouse button. Move the mouse along the same track until the 4 second mark and click, again, with the left mouse button.

You have just created a new size-sequence for the “Cube” object. Starting from the 0 second mark and ending at the 4 second mark.

The “Edit key” window will now appear twice. The first time to allow you to set the first key at the 0 second mark as well as the current size of the object. Leave this unchanged for the moment and simply select the OK button. The second time the window appears is for the 4 second mark. Change the size of the cube to about half and click the OK button. Cinema4D has now created new first and second keys at the 0 and 4 second marks, with the second mark having an alteration to its size.

In the “Time Line” window we now see your new sequence with both keys. Let’s have a look at the results:

☞ Close the “Time Line” and render an animation as before.

☞ Open the “Play” window and click on the “Play” button.

Immediately, the cube starts to move from left to right. This time, however, it shrinks to about half its original size by the time it is halfway across the screen.

You will find a ready-made version of this scene listed as “Tutorial4” on your hard drive.

☞ Using the left mouse button to set the start and end points, create another new sequence in the size track. Set the start point to the 6 second mark and the end point at the 10 second mark. Leave the values for the first key as they are, but change the values for the second key so that they are three times as big.

☞ Render the animation again and view your results in the “Play” window. This time the cube moves, as before, starting to shrink to half its original size (as set in your first sequence), the cube then rapidly expands to 3 times it’s previous size by the end of the animation.

Summarising, the “Time Line” is primarily used to visualise the progress of sequences and keys in your animation. Making it easier to see when a sequence begins and ends, and whether it overlaps another sequence. It is also important to note that when using the “Time Line”, you can set any number of sequences and keys for each of the various animation styles.

6. Material Animation

We are now going to use the animation created in the last chapter to investigate the effects of not only altering the cube's position and size, but also its surface.

- ✎ To start with, let's call up the "Material Manager" and load the "Yellow Plastic" and "Red Plastic" materials.
- ✎ Define a new sequence in the "Time Line" starting from the 0 second mark to the 10 second mark, on the cube's material track. Select "Yellow Plastic" in the window for the first key and "Red Plastic" for the second key.

You have just created a sequence that will cause Cinema4D to change the cube's surface from "Yellow Plastic" to "Red Plastic" over a 10 second period.

So that we can see the animation in colour, you must now render the animation using one of the other render modes.

- ✎ Using the right mouse button, choose "Scanline" from the Render button. Click on "Medium Picture" and activate the save option in the output section. Give the files a name and path, e.g. T:Test.
- ✎ Check that Cinema4D will be rendering from the 0:0 mark to the 9:14 mark and start rendering. This will take a while.

Cinema4D will now render 150 frames with colour and lighting effects.

Unfortunately, you won't be able to display these frames in the "Play" window, because Cinema4D normally only runs on an eight colour screen. Instead, start the "AnimGen" program. This can be found in the Cinema4D tools drawer.

- ✎ When the program's window opens, the first thing you should do is enter the name that you want your animation to have. Enter something like "Anims:test.anim" in the "Animation" input field and hit the return key.

- ☞ Click on the button to the right of the “First Picture” field and choose the directory in which you rendered the frames.
- ☞ Click on the first file rendered, i.e. “Test.0000” and then click on OK.
- ☞ Now hit the “Build” button. AnimGen will now generate an ANIM5 animation from all the rendered frames. This may take a while.
- ☞ Once this has finished, start the “Viewtek” program and choose the name of your animation from the file requester.

You can find this tutorial in the Scenes directory under the name “Tutorial5”.

You should now be seeing your first colour animation from Cinema4D. The cube doesn’t just move across the screen, it also changes its colour.

7. Special Effects

We are now going to learn how to use special effects and we will use our last scene with the colour-changing cube.

Bring up the “Time Line” again. The lowest track; “Effect”, is for applying special effects to an object, and Cinema4D has lots of these effects. You can explode an object, make it move like a flag in the wind, or even melt it like butter in an oven.

- ☞ Firstly, activate the cube in the document window. Choose the “Subdivide” function from the Tools menu four times in a row.

The cube should now be made up of a vast number of tiny squares. We need to do this to make the explosion look more realistic with lots of flying fragments.

- ☞ Make a new sequence on the “Effects” track starting at 0 and ending at the 10 second mark.
- ☞ A window will pop up in which you can choose the effect you want. Leave it set to explosion, and click OK.

You can find this scene under the name "Tutorial6" in your Scenes drawer.

- ☞ The "Explosion" window appears for you to set its parameters. Leave them unchanged and hit OK.
- ☞ Start rendering again and then join the frames together as an animation.

And now, in addition to the motion and colour change, the cube will explode in every direction.

8. Skeletal Animation

The hardest skill to learn in animation is the realistic motion of characters and people in an animation. Cinema4D makes this child's play.

- ☞ Close all documents and open a new one. Choose the "Figure" item from the "Objects/Special Objects" menu. Cinema4D now automatically creates a simple, stylised, humanoid figure with moveable limbs. These are ideally suited to skeletal animation, and this figure has already been prepared with all the axes and hierarchies for skeletal animation.
- ☞ Open the Time window and set it to the 0 second mark.
- ☞ Click on the "Edit" object button in the main toolbar, select "Rotate" and make sure that only the "X" button is highlighted.
- ☞ Activate the "Upper Arm" object (it's in the "Figure/UpperBody" object group) and then click the record button in the time window. The position and direction of the upper arm is now saved as a keyframe for the 0 second mark.
- ☞ Now go to the 10 second mark and move the arm to a new position, then click again on the "Record" button. This will once again save the position and direction in a new keyframe.

For the most natural movements you should use a "Cubic" interpolation for the "Space interpolation" style.

You'll find this scene filed under "Tutorial7" in the scenes directory.

So far this has been no different to the previous cube animation.

- ☞ Now activate the "Lower Arm" object which is a sub-object of the upper arm. Go back to the 0 second mark and save a new keyframe. Then zip to the last frame of the animation. Rotate the arm a little further than you did the upper arm and click the "Record" button again. Cinema4D has now stored the position of the lower arm in respect to its "upper arm" parent group in a new key.

If you rotate the upper arm in this way, the lower arm automatically follows, without breaking the arm apart. In addition, you can overlay another motion for the lower arm.

- ☞ Move the other arm in the same sort of way.
- ☞ Render the motions you have made in the Monochrome Shaded mode and have a look at the result in the "Play" window.

In the “Time” window you will see a slider which you can use to set the current point in time. It can be set from the start to the end of the animation. The length of the animation can be set with the “Global Parameters” function in the Keyframe menu.

As you can see, there are three different styles of arrow gadgets in the “Time” window. The single arrow gadgets allow you to move one frame forwards or backwards. Doing this moves both the slider automatically along the bar and moves the scene to the new point in time in the document window. The double arrow gadgets move through the animation one complete second at a time, forwards or backwards. The buttons to the left of the “Record” button are used to go to the next or previous keyframe, as long one exists.

We will now begin by making a simple animation of a cube which starts off in the bottom left-hand corner of the screen, moves to the bottom right, then ends up in the top right corner.

- ☞ Create a new document with a cube. Go to “Perspective” mode.
- ☞ Make sure the slider in the “Time” window is set to 0 seconds.
- ☞ Place the cube in the bottom left-hand corner of the document window.
- ☞ Click on “Record”. Cinema4D now saves the position of the cube at 0 seconds.
- ☞ Move the slider to the 8 second point, or enter 8 seconds in the “Current Time” function in the Keyframe menu.
- ☞ Move the cube to the bottom right corner of the document window and click on the “Record” button again. Now the second position is saved.

You will immediately see that a motion path for the object appears.

- ✎ Finally, set the slider to its last position (10 seconds is the default animation length when you start the program). Move the cube to the top right corner of the document window and click the “Record” button to save the third position.

In time notation, 09:14 is the end of the tenth second at a frame rate of 15 frames per second.

The motion path changes shape into a soft curve. The whole sequence is performed using the predefined cubic interpolation.

The animation is now practically complete. You can check this by moving the slider to any point between 0 and 9:14 seconds.

You will see that Cinema4D moves the cube to the correct position on the motion path for the time you have set. Therefore, the cube will be halfway between the first and second keys if you set the slider to 4 seconds.

As we described earlier, the three position keys have been grouped by Cinema4D as a sequence. This sequence starts at 0 seconds and lasts until 9:14 seconds (the length of the animation).

So that you can assess the animation, you should start one of the rendering algorithms.

- ✎ Click the “Render Picture” button with the right mouse button and choose the “Monochrome-Shaded”. In the window that appears, enter the details that frames from 0:0 to 9:14 should be rendered into the “From” and “To” boxes.
- ✎ Click on the “Output” button and activate the “Save” options. Enter a path- and file-name under which you want to save the frames of the animation, e.g. “T:Test”.
- ✎ Close the “Output” window by hitting the OK button and start rendering.

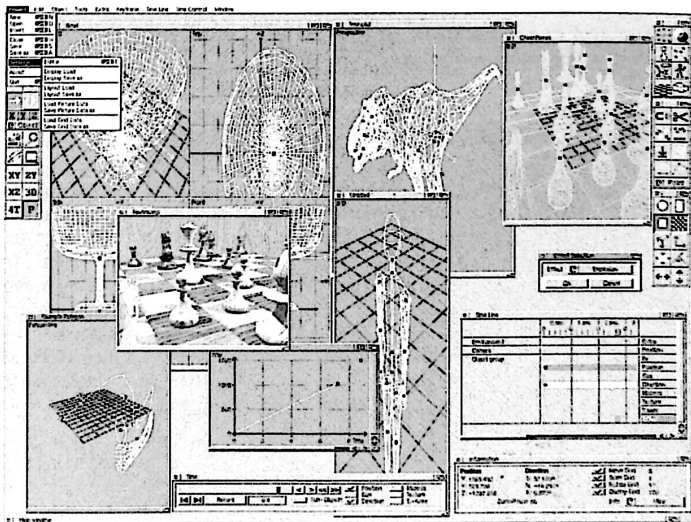
Cinema4D now starts rendering the 150 frames which will be saved as “T:Test” together with a file suffix consisting of the frame number.

Basics

The section covers some of the important principles of the Cinema4D package. Please read through this section of the manual as carefully as possible.

1. Document

Cinema4D works in a document-oriented fashion. That is to say, each open document consists of various attributes comprising the scene (forms, polygons, light sources, camera etc.), materials and render preferences. Each document has its own settings for the attributes, and each document can be fully, or partially, saved to hard disk.

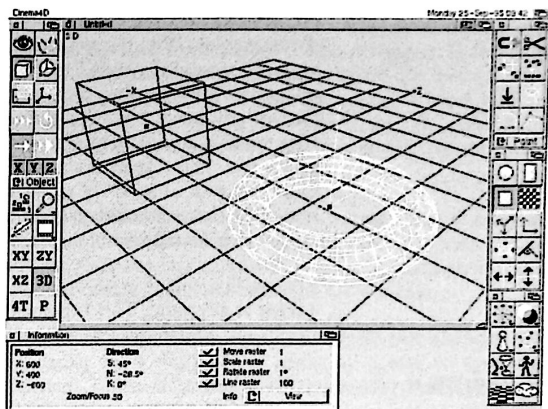


Picture 1

The menu functions and toolbars within Cinema4D only work on the currently active document. A document is active when you click in its window. To bring a document window to the front, click on its lower edge.

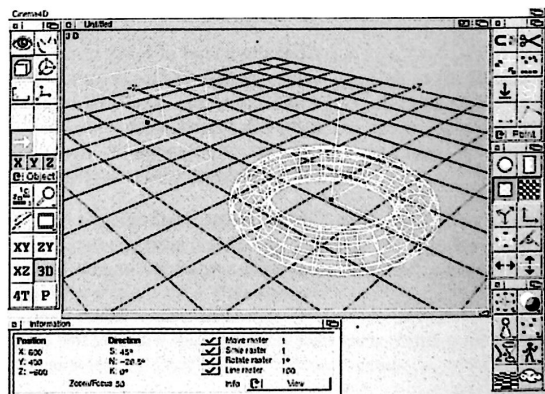
Picture 1 shows a typical example of the Cinema4D interface in use. The greater part of the display is taken by document windows, each displaying objects. The picture also shows several toolbars on screen, notably the main toolbar (far left); this is the most important toolbar and is always displayed. The main toolbar contains the most important functions and tools. Cinema4D also has other function related toolbars, these toolbars contain frequently used functions, such as the editing of textures or the manipulation of points. The location of windows and toolbars is not fixed and all can be positioned in the same way as Workbench windows (moved, closed, hidden etc.).

Cinema4D differentiates between a user interface with eight (or more) colours and one with only four, such as Workbench. If you set Cinema4D to only use four colours, or make it open on the Workbench screen, then all documents will be drawn in the background colour. Active objects will be drawn in white and inactive objects and the grid will be drawn in black. Unfortunately, due to the lack of available colours, you will encounter display problems when an active object is overlaid onto an inactive one. This can result in an unpleasant blue colour appearing. This can be fixed by changing the fourth colour in the palette to a light grey. On the Workbench you should use the "Palette" program in Prefs, on a four-colour Cinema4D screen, use the "Editor" item from the "Project/Settings" menu. On one hand, working in four colours is faster than eight or more, on the other hand, working in eight or more colours gives no problems when objects are overlaid. A greater number of colours also gives Cinema4D's windows a greater aesthetic appeal, with deeper shades of grey, and improved object and grid definition.



Picture 2

In picture 2 you can see Cinema4D running in four colours, such as Workbench, whereas picture 3 shows how it looks in more than four colours.



Picture 3

Cinema4D allows you complete freedom in your choice of the document view. With the option to view the scene either in one of the three parallel views (Top, Front, Side), in one of the two perspective modes (editor camera or perspective camera) or in the four view mode: top, front, side and editor camera. The four view mode is especially recommended for a good overview of your scene. This display is also particularly suited to graphics card users with a big (17" or more) monitor. The screen update is slightly slower when displaying the four views, but it does give a better overall view of the scene.

Cinema4D is unique in allowing you to interrupt the drawing of a scene at any point. This is particularly useful when trying to manipulate a complex scene that can take minutes to redraw.

2. Menu

All the functions that are not present on the main toolbar can be found in one of Cinema4D's menus. Cinema4D doesn't have special modes for object creation, animation or materials. Instead, Cinema4D has a single, structured, user interface that will make every task simple and intuitive. In addition, there is only one unique menu valid for all the windows.

After the names of many of the menu items you will see three full stops, for instance, have a look at the Project menu and you will see an item labelled "Save As...". The three full stops, otherwise known as an ellipsis, indicate that the menu item will open an input window, in which you must enter various parameters (e.g. path or filename) for the function to work.

Menu items without the ellipsis execute immediately. Cinema4D also gives you functions which, when you want them to, open a window for you to enter new values, or execute immediately with the pre-defined values. These items have a "•" after their names. Menu items like "Warp •", for instance, let you know that you have two options for using this function.

When you use a menu item with a “+”, Cinema4D will execute the function using the function's default parameter. However, if you hold down the shift key when you select this menu item, a window will appear, just as though the menu item had an ellipsis after it. The shift key can also be used in conjunction with the function's keyboard shortcut to achieve the same effect.

Most menu items can be called up by hitting a key, or a key in combination with another one as a modifier (e.g. <ALT> or <Right Amiga>). All keyboard shortcuts are displayed in the menus if you are running Workbench 3.0 or higher.

As you gain more experience with Cinema4D, you will learn the frequently used shortcuts to speed up access to common functions. In the meantime however, you may find it easier to stick to just using the mouse.

3. Toolbars and Windows

Cinema4D provides various toolbars to aid the building of scenes. The main toolbar is the only one that cannot be closed. Within it, you will find the most commonly used editing functions.

Various other toolbars are available. If you look in the Window menu, you will see names such as “Point Bar” and “Texture Bar”. If you select one of these items, the appropriate window will appear on the user interface and the menu item will have a tick displayed next to its name.

You can close all the toolbars, apart from the main one, at any time, by selecting the item with the tick in the Window menu, or by clicking on the close gadget in the top left corner of the window.

If you click on the close gadget for the main window, it is the same as selecting “Quit” from the Project menu.

All functions that you can choose from the menus behave in the same way as their toolbar counterparts.

In the same way that some menu functions have a “•” to cause a different action when shift-clicked, so to do many gadgets have different meanings when right-clicked. If you click on the “Render” button with your left mouse button, your scene will immediately start to render using the preset quality and size settings. The same action, but with the right mouse button, will first bring up a requester in which you can choose various options before starting a render.

Many gadgets have a small black triangle in the lower right corner. This indicates that the button hides more than one function. When you click on the button, a pop-up menu will appear with further options for you to select. To cancel a selection you need to move the mouse away from the options and release whichever button you are holding down.

As well as the toolbars, you can also open what is known as the “Information” window. This shows important data about the active object or function. In a complex editor like Cinema4D, there is never enough space to display every little bit of info, so the data is stored in several thematic groups. The “Info” cycle gadget in the “Information” window lets you switch between these groups.

Cinema4D is also unique in providing the ability to work in a non-modal environment. If, for instance, you move an object in the document window, you will be able to observe, at the same time, the changing co-ordinates in the “Information” window. That’s not all, Cinema4D also allows you to work the other way around. You can even change values directly in the “Information” window and the changes will be instantly conveyed in the document window.

Cinema4D also allows you enter formulae and functions into the “Information” window’s settings. If, for instance, you want your object to be scaled to two and a half times its normal size, simply enter “*2.5” and your object will immediately be resised in the document window.

✎ Further discussion of the possibilities for formulae can be found in Chapter 8 “Units and Functions”.

You can also save your own personal arrangement of windows and toolbars. When the editor starts up, this arrangement will be automatically loaded and you will be able to work in your favourite environment. You also have the option of saving more than one layout so you can choose between them.

4. Requesters

Many functions bring up requesters into which user defined parameters can be entered. To avoid the annoying task of having to activate each field using the mouse, Cinema4D allows you to use the <TAB> key to cycle from field to field. To cycle backwards through the fields, use the <TAB> key while holding down one of the Shift keys. The up and down cursor keys can also be used in a similar manner to allow easy access to all fields.

If you look closely at the field names, you will often see that one of the letters is underlined. If you hit this letter on the keyboard, its field will be activated. This only works, however, when there are no activate input fields in the window. Hitting the return key will also deactivate any active input field. To close a requester, you can use the <ESC> key.

In a numeric input field, you should enter the desired unit or measurement after the numerical value such as “cm” or “km”. If you do not enter a value, Cinema4D will assume the default measurement value that is set in the editor preferences. As an example, all the following entries are identical as far as Cinema4D is concerned: “12cm”, “0.12m”, “12E-6km”, “120mm” or even just “120” when the basic measurement is set to “mm” (cf. Chapter eight “Units and Functions”).

If you’ve made a mistake in you input - that is, if you’ve entered the wrong sort of measurement, or your value is outside the permitted range of values. Cinema4D will automatically inform you of the error when you close the window. Cinema4D will also provide you with details of valid ranges or entries. Thus, Cinema4D makes it impossible to enter an incorrect value or setting.

Studies have shown that, from function to function, the values changed are, as a rule, only trivial ones (e.g. the name of an object). Cinema4D therefore has the ability to store the values you entered into a requester so that the next time you call up the requester, you will see your previously-chosen values in it, rather than the standard ones.

5. Confirmation

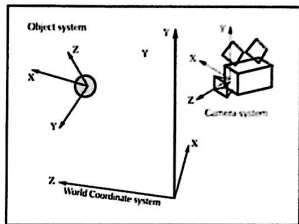
Before starting an action from which no “undo” is possible, Cinema4D will always ask you whether you really want to go ahead with that action. A window will appear in which you can choose to start or cancel the action. Experienced users, who don’t need such hand-holding, can turn off these queries in the preferences.

Some functions within Cinema4D can require a considerable quantity of RAM. If there isn’t enough available for the desired function, Cinema4D will inform you of this. At this point, you have the option of trying to free up some more RAM by closing down other programs that are running, or of cancelling the operation.

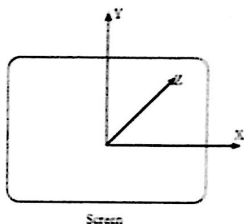
If Cinema4D doesn’t even have enough RAM available to open the window telling you that there isn’t enough RAM free, then a “Guru” message may appear - a clear indication that you need more RAM. More often, Cinema4D will simply flash the screen indicating that the desired function could not be accomplished.

6. Co-ordinates System

Cinema4D works with various co-ordinate systems, the most important of which is the World Co-ordinate System (Picture 4). It is three dimensional with axes for the X, Y and Z directions. The X axis stretches from left to right, The Y axis from below to above and the Z axis from front to back (when looking in the Z direction).



Picture 4



Picture 5

For many functions the arrangement of an object according to its axis is important.

Cinema4D defines the Z axis as the "Pointer" axis. An object follows a path along its "Pointer" axis and the camera always looks along it at the scene.

The World Co-ordinate System is - in contrast to the usual right-handed co-ordinate system used in mathematics (where the Z axis points at the onlooker) - a left-handed system. This was chosen on purpose, as most 3D object editors use such a system.

In addition, each object has its own Object Co-ordinate System. This system is displayed as the three axes and the origin point in an active object. For reasons of clarity, only the origin point is visible in inactive objects. The Object Co-ordinate System can move with the object or it can be altered independently of the object.

The Camera Co-ordinate System is basically the "Object Co-ordinate System for the camera."

All objects in a scene, that are displayed on the screen, follow a depiction method (two-dimensional parallel depiction or a perspective depiction) which can be transformed using the Screen Co-ordinate System. The origin for this system is the centre of the document window displaying the scene, with the X axis going to the right, the Y axis pointing upwards and the Z axis points pointing into the monitor (Picture 5). The Screen Co-ordinate System is also independent of the currently selected view (top, side, front, etc.).

7. Grid

If you are using the perspective views, the display grid will only be drawn in the XZ plane from the World Co-ordinate System's origin point. If this wasn't the case, the screen would be filled with grid lines and you wouldn't be able to see, or edit, your objects. The Move grid is independent from the display grid. It is sensible to make one of the grids a multiple of the other. This gives excellent control of objects.

The scale grid is just like the move grid and is independent of the display grid. You can switch it on in the "Information" window. The rotation grid is just like the move grid and is independent of the display grid.

Cinema4D makes use of various styles of grid to help you accurately position and rotate your objects.

The most important grid is the "Display Grid", this is shown as a series of vertical and horizontal parallel lines and are used as a visual aid to orientation. You can set the interval between the grid lines within the "Information" window. If the grid lines become too close together, the grid will disappear, care should be taken to avoid this.

Even when you have the display grid switched on, it is still sometimes difficult to position an object exactly on a grid line. A tiny movement of the mouse may still result in your object jumping to the wrong point. To help with this, there is the Move grid. It doesn't help you by putting lines on your document window, but by only allowing you to place objects on a multiple of the value entered. This will prevent the free movement of objects until the Move Grid is de-selected.

If you have set the move grid to 10 units, and activated it, then an object will jump from its current position, say 10 units, to its new position at 20 units, and so on. An object at position 5.6 will therefore jump to the points -4.4, 5.6, 15.6 and so on.

A good compromise between free and exact movement of your object is to set the move grid to a very small increment, 1 unit say. The object's co-ordinates will always be integers but you will still be able to move the object with relative freedom.

When you want to create and edit regular objects, you should set the move grid to more suitable value. An architect can make the foundations for a house very quickly this way, because most bricks are arranged at right angles and their size is a multiple of an exact base length (a brick is about 30cm long). The walls can then be made in exact multiples of a brick's 30cm length using a 30cm grid.

The move grid has another important function: it ensures that all new objects or points will appear on a grid point.

The Scale grid works in a similar manner to the Move Grid by allowing you to only scale objects by a certain amount. Therefore a value of 10 units means that the object can only be scaled in 10 unit increments.

Finally, there is a fourth grid, the Rotation Grid which is set in degrees. A value of 10° lets you rotate an object in 10° increments. This can be particularly useful for positioning cameras and light sources.

8. Units and Functions

Expressions can be used

It doesn't matter whether you use upper or lower case letters

Rotation input doesn't need to have a degree symbol (°) in it, as it will be automatically added.

The number e (Euler number) can be expressed with the term Exp(1).

The (, { and [brackets can be used in any combination.

Units are freely usable, e.g. "5km+3cm-14µm".

The entry for an objects position, etc. will not be snapped to a grid unless the move grid is active.

Cinema4D lets you use both metric units or pixel values. The default base unit can be set in the preferences, and this is the value given to all numerical values displayed.

However, should you wish to enter values in a different unit, this can be done by typing the unit after the value entered. For example, the values 2mm and 0.2cm are the same.

Cinema4D recognises all important metric units such as nm (nanometre), um or µm (micrometre), cm (centimetre), dm (decimetre), m (metre) and km (kilometre). You can also enter pixel values (without a unit).

There are also different units for use with animation. One of them uses "F". You could type in "510F" and Cinema4D would know that you wanted frame 510.

The other is normal time notation, using the form "Min:Sec:Frame". For example, "3:20:14" means 3 minutes, 20 seconds and the 14th frame mark. The last value is not in hundredths, but actual frames. The reason for this is due to the fact that animation rate, or frames per second, can vary from one animation to another.

If you wish, you can omit the minutes part of this notation (e.g. 15:14), the first value now becomes seconds, and the second value becomes frames.

Because the “μ” character is tricky to get at on the Amiga keyboard, you can use “u” instead. (On a UK keymap, μ is entered when you use the ALT key and u)

If you enter a number without units, then the animation unit defaults to the setting in the editor preferences (cf. Reference 1.7.1) . Thus, if the animation unit is set to frames then the value you enter will be a frame number, otherwise it will be displayed using the standard time notation.

Cinema4D has a parser for the entry of formulae. For example, you can enter “*1.8” into a field, Cinema4D will then proceed to multiply the previous value by 1.8. Thus making all mental arithmetic and calculators superfluous.

A formula can consist of up to 128 characters.

The following table lists all the functions, and their characteristics, understood by Cinema4D.

Symbol	Function	Example	Result
+	Addition	4+5	9
-	Subtraction	4-5	-1
*	Multiplication	4*5	20
/	Division	4/5	0.8
Sqr()	Square	Sqr(4)	16
Sqrt()	Square Root	Sqrt(4)	2
^	Power	2 ^ 3	8
Sin()	Sine	Sin(30°)	0.5
Arcsin()	ArcSine	Arcsin(.05)	30°
Cos()	Cosine	Cos(60°)	0.5
Arccos()	ArcCosine	Arccos(0.5)	60°
Tan()	Tangent	Tan(45°)	1
Arctan()	ArcTangent	arctan(1)	45°
Rad()	Radians	Rad(180°)	Pi
Deg()	Degrees	Deg(Pi)	180°
Log()	Logarithm	Log(100)	2
Ln()	Natural Logarithm	Ln(100)	4.605
Exp()	Exponential function	Exp(4.605)	100
Abs()	Absolute value	Abs(-2)	2
Frak()	Decimal places	Frak(1.234)	0.234
Int()	Integer value	Int(123.4)	123
pi	π	pi	3.141592654
(...), [...], {...}	Brackets	4*(3+2)	20
E	Exponent	4E2	400

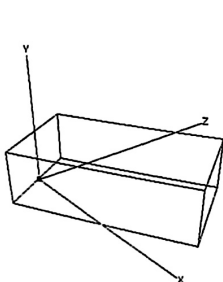
9. Rotation System

In addition to position and size, another important parameter for describing a body in three dimensional space is its attitude, or direction. There are many different methods of describing a body's attitude and Cinema4D uses the one known as the Euler angle. This angle is often used in mechanics for describing a rotation system. It is the closest to the human way of describing the direction of a body in space.

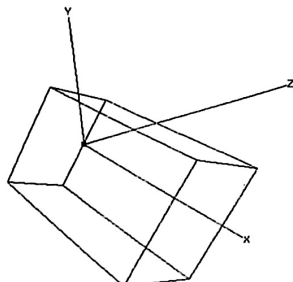
An object is always rotated about its heading first, followed by its pitch and finally, its bank.

The Euler angle is depicted as a triple-angle, similar to an axis.

The first angle is the one known as the Heading angle and it is used to rotate the object about its Y axis. If you are looking straight down at the Y axis, so that it is pointing towards you, then it will be rotated in the mathematically positive direction (anticlockwise). See Picture 5.

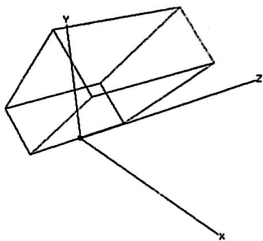


Picture 5

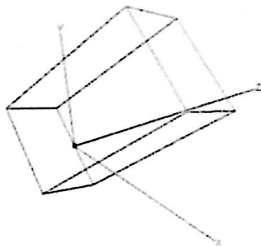


Picture 6

The second angle is called the Pitch angle and it rotates the object about its X axis (Picture 6). Finally, there is the Bank angle, which rotates an object about its Z axis (Picture 7).



Picture 7



Picture 8

The combination of the heading, pitch and bank angles allows you to describe the attitude of any body in space.

In Picture 8, you will see the combination of all three directions with a heading of 30° , a pitch of 60° and a bank of 45° .

All three angles are completely independent of one another. Thus a change in one of the three angles cannot change either of the other two angles.

10. Camera Model

Cinema4D uses two different synthetic cameras for generating realistic scenes.

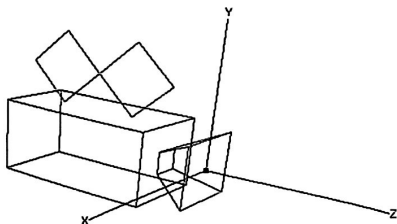
The editor camera is exclusively responsible for building objects within the editor. The perspective camera is independent from the editor camera and is the view used for rendering pictures. The editor view can therefore be different to the perspective view.

Since both the views are separate, you can move one of these views without altering the other. This means that you can move your editor camera in for a closer look at an object, without upsetting the spectacular view you have set in the perspective camera.

Cinema4D projects a central perspective display of objects onto your computer screen - the way they would look if portrayed by a synthetic camera. To obtain this, Cinema4D uses a Camera Co-ordinates System that allows you to fix the cameras position and rotation in space absolutely.

The editor camera is not displayed in the perspective view.

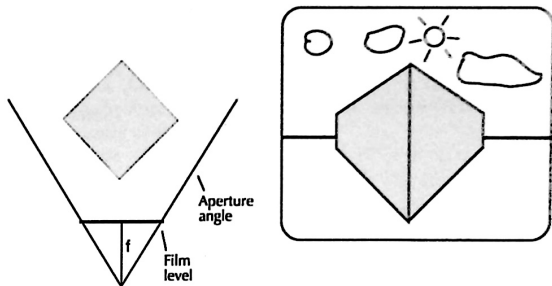
The co-ordinate system of a camera always lies so that the X and Y axes change the focal point, while the Z axis gives the direction that the camera “points”, i.e. the view shown in the editor. The camera is depicted in the editor as a box with two film cans on top and a lens (Picture 9).



Picture 9

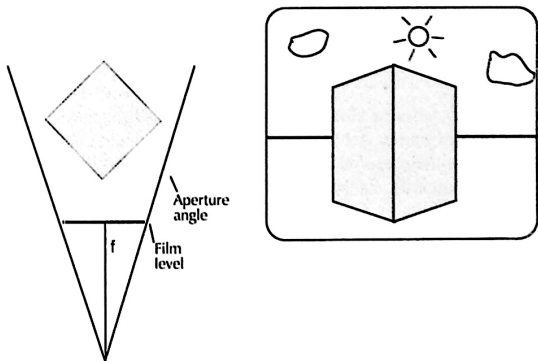
As with real world cameras, Cinema4D's cameras can also have different types of lens systems. Cinema4D allows you to change the focal length of the lens to allow a wide variety of camera shots.

A small focal length will give you a wide angle lens. This will give you a good overview of the entire scene. Should you want to distort your objects, you could enter a very small value for the focal length to produce a fish-eye lens (Picture 10).



Picture 10

Large focal lengths will give you a telephoto lens. This produces pictures that only show a small section of your scene due to the lens giving a small aperture angle (Picture 11). At this point we should point out that you shouldn't set the focal length too long. Doing so may result in your scene losing all depth of vision, with objects appearing as though they were rendered in a parallel projection.



Picture 11

Lens	Focal Length
Fish-Eye	20mm
Very Wide Angle	28mm
Wide Angle	35mm
Normal	50mm
Portrait	85mm
Telephoto	200mm
Telescope	1000mm

11. Objects

Every object in Cinema4D is either a faceted shape, a sphere, a polygon or a light source. In addition, there are the Ground, Sky and camera objects that can only appear once in a scene.

Every single object has its own Object Co-ordinate System, with the point of origin for these systems being shown as a small black square. As soon as you activate an object, its axes will instantly become visible.

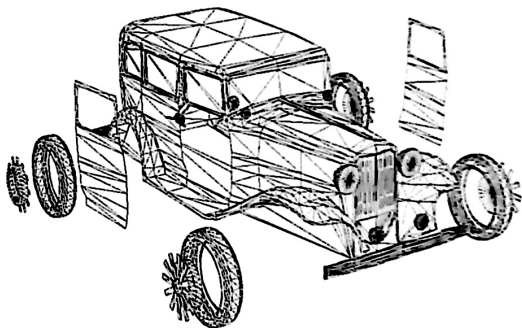
To activate your desired object, simply click upon the object's origin square. Clicking with the left mouse button will activate the object and all its sub-objects, should it have any. Clicking with the right mouse button will select only the object itself, without any sub-objects.

You can also choose an object to activate using the "Select Object" window, found on the Edit menu (cf. Reference V.2.6).

You will often want to combine several objects into a new one, this is done by grouping them into hierarchies. All objects except the Ground, Sky and perspective camera can be arranged hierarchically.

Objects with sub-objects will be referred to from now on as object groups.

Apart from those objects, every object can have one or more sub-objects. For example the object “CarBody” can have the sub-objects “LeftDoor” and “RightDoor” (Picture 12). If the “CarBody” object is chosen then its sub-objects will be automatically chosen too.



Picture 12

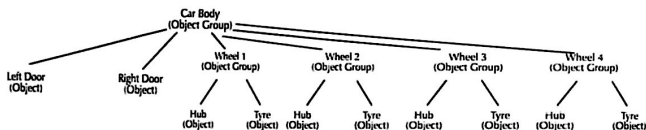
When choosing your object, you can decide whether you choose the whole object (clicking on it with the left mouse button) or a sub-object (by clicking with the right mouse button). This is true for all the object editing functions within Cinema4D.

Because object groups combine many smaller objects into one large object, a suitable method of structuring the large groups of objects is required. This is especially important when you come to move the objects.

When we talk about objects in the text, we mean all types of object including bodies, light source, polygons, etc. The explicit meaning of the word "bodies" in this context always means faceted objects or spheres.

If you have twenty five separate objects that you want to move, you can either move each object twenty five times or, you can group all twenty five objects and move the single group of sub-object once.

Hierarchical object structure is an important prerequisite for working professionally with 3D objects. You certainly can't do much in terms of animation without hierarchies. Picture 13 gives an example of a hierarchical organisation. The "CarBody" object contains the sub-objects "LeftDoor", "RightDoor", "Wheel1", "Wheel2", "Wheel3" and "Wheel4". This represents an object group. Each of the wheel objects is, in this case, an object group itself and contains the sub-objects "Hub" and "Tyre".



Picture 13

12. Points, Edges and Faces

Squares have the unusual feature of taking less time to render.

Every body in Cinema4D consists of a certain number of faces, which can be either triangles or squares. Using these two elements, you can make any imaginable shape or surface.

The corner points of each face is connected by lines, these are known as edges. As you would expect, a single triangle has three edges and a square has four.

Cinema4D also lets you edit the points and edges of a face. This means there is no problem should you want to build a new object from scratch, or rotate a group of points out of a whole selection.

You can even load an ASCII file containing point co-ordinates, such as those from a 3D scanner, to use as the basis for the definition of a new object (cf. Reference V.5.2.8).

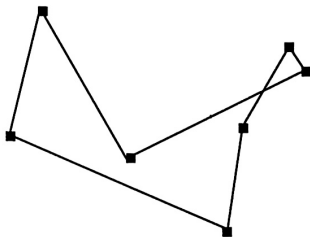
13. Polygons

Polygons are an extremely important, and powerful, part of Cinema4D. Not only can you make complex objects in seconds, but you can also use them as motion paths for objects and cameras in an animation.

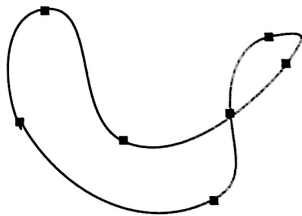
Primarily, polygons are made up a series of support points, in three dimensional space, through which a line is drawn. The path of the line between the support point can however vary depending upon the polygon style being used. These styles can vary from the simple direct connection, to a smooth curve with no corners or jumps.

Cinema4D has five different polygon interpolation styles: Linear, Cubic, Akima, B-Spline and Jump.

- The simplest style, Linear, connects the support points in a polygon with straight lines (Picture 14). You can use this polygon to create angular objects or to simulate a jittery motion path.



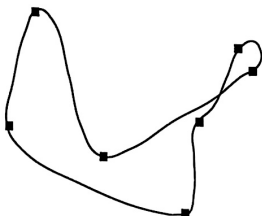
Picture 14



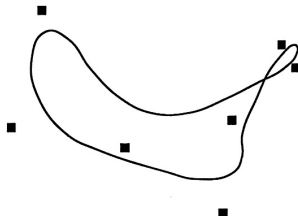
Picture 15

If, in spite of the various cubic, Akima and B-Spline interpolations, you are still getting corners in your curves, you can double the relevant support points.

- The Cubic interpolation creates a smooth curve between the points. The cubic-interpolated curve always passes directly through each support point, it does however have a tendency to overshoot tight bends. This effect can be seen on two right-most points in Picture 15. As you can see, the curve between the two points stretches further than is really necessary. This becomes especially clear when you compare the same section of curve using the Akima interpolation.
- The Akima polygon style creates a smooth curve between the points, the curve always passes exactly through the points, but without any overswing (Picture 16). This makes it ideal for producing tight curves, it can however appear harsh. If this is the case, you can use the Cubic interpolation method.



Picture 16



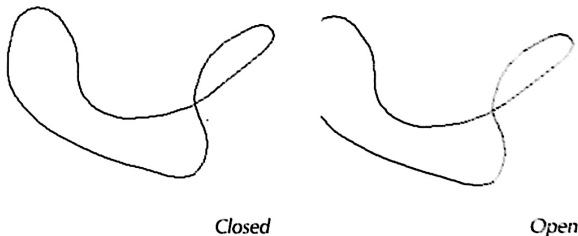
Picture 17

- The B-Spline interpolation method creates a smooth curve which doesn't have to pass through the support points (Picture 17). A curve created with this interpolation is the smoothest. The support points only roughly determine the course of the curve. The idea behind this interpolation method is that the points are there only to influence the direction of the curve. Thus, points that are widely spaced have less influence than those which are closer together.
- There is a special interpolation for use in animation called Jump (Picture 18), which isn't really an interpolation at all. It simply makes an object following the curve jump from point to point, rather than moving along the curve.



Picture 18

Each polygon can be open or closed (Pictures 19 and 20). If a polygon is closed, its start and end points are connected to each other. It should be noted that there is a difference between a closed polygon and one where the start and end points are put on top of each other. In the first case, the curve continues smoothly through the points, whereas in the second case, the start and end points will jump abruptly from one to the other.



Pictures 19 + 20

You can set whether a polygon is closed and its interpolation style in the “Information” window’s Parameters page (cf. Reference V.9.1).

For Mathematicians

The cubic interpolation is achieved by applying a cubic polynomial to each section of the curve. The polynomial needs continuity between the first and second support points to ensure a smooth transition between the individual polynomials.

The Akima interpolation is achieved through the application of a cubic polynomial to each part of the curve, but, in contrast to the cubic interpolation, only the first arc of the support points is followed to achieve a smooth path between the individual polynomials. This cuts out any overswing through a curve, but will produce a curve that is not as smooth.

14. *Lighting Model*

So that the surfaces of objects can be seen by human eyes, objects must reflect a certain amount of light falling on them while absorbing the rest. Unfortunately, this isn't the only rule, the view of the object's surface also depends upon a set of complex attributes comprised of the objects surface-structure and its physical material parameters. Also, there are often many lights to illuminate an object's surface. In addition to direct sunlight, there is scattered light from the atmosphere, as well as the walls of houses and other objects which create indirect light. This can be seen in a room with only one window through which sunlight is streaming. Obviously, it isn't only the section of the room on which sunlight is falling that is visible. Instead, all parts of the room are lit with more or less even diffusion.

A life-like render and reproduction of all these factors is not yet practical with current algorithms and computers. That's why we are limited, in practice, to fewer parameters to approximate materials and lighting. The parameters to select are therefore the ones which have principle impact over the 3D scene.

Cinema4D's first approximation is the analysis of the entire visible light spectrum in the three separate colour ranges, red, green and blue. Just as a colour TV, where the colours that are displayed are mixed from the three primary colours red, green and blue, Cinema4D calculates the illumination for each colour range separately.

The indirect environmental or ambient light (as in an un-lit room) can be described by a constant value. A value of 0% red, 0% green and 30% blue will give a dark blue ambient light. You could use this to simulate a night scene. Obviously, this is only a gross approximation, but, in practice, is hardly noticeable, because the direct light from a light source has a much greater effect on the look of an objects surface. Then we have the “Colour” parameter for the object. This determines the percentage of, and type of, light that is reflected or absorbed by an object. A value of 100% red, 0% green and 0% blue tells us that the material will appear red, while the green and blue parts of the spectrum will be completely absorbed.

It's the same for the “Transparency” parameter. This sets how much of the light falling on an object, will pass through its surface. If you want an object to only let green light through, then you will need to set the values to 0% red, 100% green and 0% blue.

In contrast to colour and transparency, which describe how light falling onto the object should be handled, “Reflectivity” determines how strongly a material should reflect back rays of light from other objects. For example, a perfect mirror has reflectivity values of 100% red, 100% green and 100% blue.

Another important parameter dealing with how materials look is “Highlight”. When you look at an object you can see that smooth surfaces like plastic or glass have a white fleck in several places, the smaller the fleck, the smoother the surface is. Cinema4D allows you to set the colour and size of these highlights as a material. As a rule, a white highlight is suitable for most surfaces, whilst metallic surfaces, such as bronze or gold, should have a yellowish highlight.

The “Relief” parameter sets the size of highlights. A value of 30% will produce small highlights, similar to those found in glass, while a value of 50% produces a plastic effect, and a value of 80% produces a very rough surface. Of course, you can leave out highlights altogether.

If the description of all these material parameters is too complicated for you, don't despair. You can always fall back on the extensive material library provided with Cinema4D. Setting individual material parameters is only necessary for professional use.

Sometimes you might want your objects to have the same degree of illumination all over, independent of how strongly lit it is, or from which angle it is being viewed. To achieve this, you can set the "Luminosity" parameter. An object that has its luminosity set would therefore appear using its defined colour even in pitch black surrounding. In addition, the normal surface colour from the light falling on the object can be mixed in with the luminosity colour.

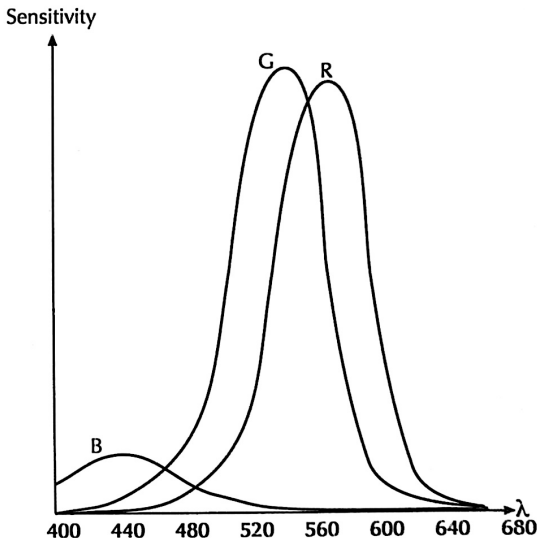
You can also set the "Refraction" (Index of Refraction) parameter for simulating glass or water. This sets how strongly rays of light passing through your object are bent, provided that your surface is actually transparent.

The switchable "Fresnel" option uses the entered transparency and reflectivity values independently from the angle of view. So, for example, if you look at a glass disc, so that it is perpendicular to you, then nearly all the light passes through it and practically none gets reflected, but, look at it again at a shallow angle (or under water, for instance), then it will completely reflect its surroundings and none of the objects under it will be visible. The relationship between transparency and reflection between these two positions is infinitely variable. As an example, if you have entered 80% red, 80% green and 80% blue as transparency values, then, when viewed perpendicularly, the material will be 80% transparent and 0% reflective, but, at a very shallow angle it will be 80% reflective and 0% transparent. Also, if you have entered a value for reflectivity that is greater than 0, then this will be added to the angle-dependant value.

The Colour, Transparency and Reflectivity parameters are dependant, in a complex way, on the angle that the light and camera are at to the objects surface. An object which is positioned perpendicular to light rays will obviously be brighter than one that is obliquely lit. The exact explanation of the connection is a bit beyond the scope of this manual. If you want to know more, you should check out the titles listed in the Bibliography, particularly [1].

15. Colours

Colours characterise the aesthetic and technical merit of a picture. So, it makes sense to take notice, not only of the information content, but also the realism of the display of natural objects, particularly of pictures generated by ray-tracing programs such as Cinema4D.



Picture 21

The human eye can differentiate between more than one hundred thousand colours in the spectral range between 400nm (blue) and 700nm (green). This colour sensitivity in the human eye is thanks to the many thousands of receptors in the retina. The receptors don't all share the same sensitivity and don't all share the same wavelength of light (Picture 21). One section of receptors are sensitive to blue light wavelengths of around 440nm. While we have other receptors which are more sensitive to light in the green range around 540nm, and the red range at around 580nm.

The eye also has three different receptor types for the primary colours red, green and blue. Their spectral sensitivity and overlapping of sensitive ranges, make the characterisation of colour shades extremely difficult.

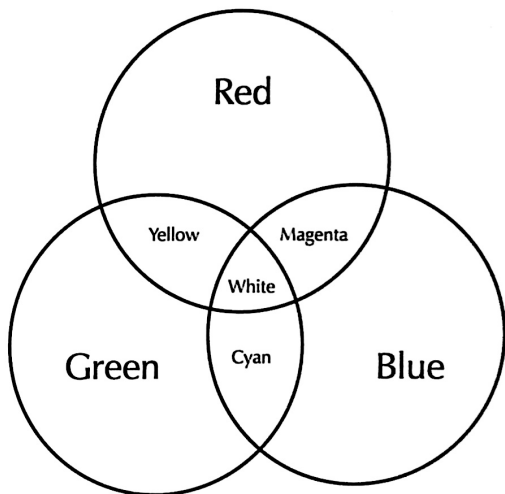
The colour that the human eye senses as white, is not made up from equal strengths of red, green and blue (chromatic colours), but must - according to the overlapping sensitivity ranges - be made up from differing strengths of each chromatic colour. Only then will the eye actually see white. In this case the light is known as achromatic.

Output devices for colour can be printers, film or computer monitors. The first two work on a subtractive process of colour mixing (CMY) and will not be discussed here. The additive process is extremely important to Cinema4D because this is the process used to reproduce colours on a monitor screen.

Colours in Cinema4D are always represented by three entered values. These work using either of the two different colour models available. Cinema4D allows you to switch between either colour model at any time.

The best-known colour model is the RGB model. Most graphics programs use it because it is how the monitor hardware sets the picture and colour output. The monitor's screen is made up of a fine grid of dots, which are made up themselves from red, green and blue dots. These dots can have an electron beam steered towards them by the monitor's electronics. The electron beam isn't actually steered to one single colour, but towards a number of colours which combine to make a new colour. For yellow, the electron beam would be directed to the red and green dots.

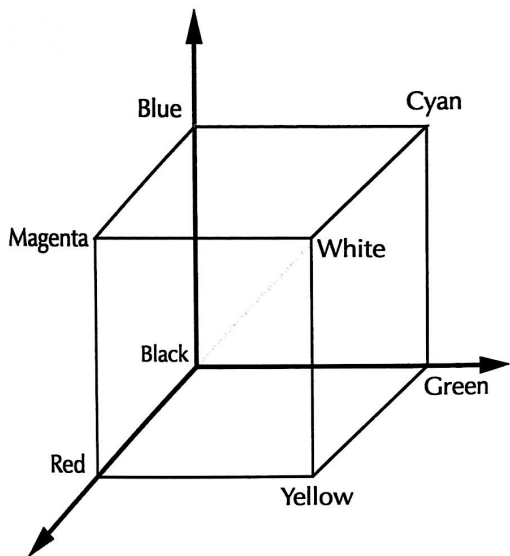
A monitor is calibrated such that equal intensities of each colour produce a white which is closest to the human eyes perception of pure white.



Picture 22

Using different intensities for the three points, eight basic colours can be made (black, red, green, yellow, blue, magenta, cyan and white) as shown in Picture 22, along with a great number of other, mixed colours. Their number can be calculated through the number of shades which the electron beam can create.

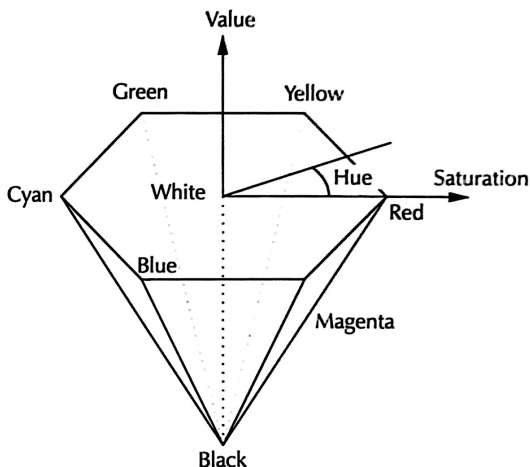
Using 4 shades for each primary colour, you will get $4 \text{ red} * 4 \text{ green} * 4 \text{ blue} = 64$ colours. As standard, there are 256 shades for each primary colour, and so it follows that you can create $256 \text{ red} * 256 \text{ green} * 256 \text{ blue} = 16777216$ different colours.



Picture 23

These colours can also be displayed using a three dimensional co-ordinate system. The co-ordinate axes show the three primary colours. Colour mixes between red and green are shown in the ground plane. If you move higher, then you will always mix in more blue, until you finally reach white in the top front corner of the cube. All shades of grey lie on a direct line between this corner and the origin.

The HSV model is better suited, than the rather technical RGB model, to a human way of thinking and working, especially for artists and painters.



Picture 24

Cinema4D always gives the values for H, S and V in percentages. An H-value of 100% means 360°, whereas an S-value of 50% means 0.5.

H (hue) means the colour tone, S means saturation and V stands for value (the colour's shade). Picture 24 shows what is meant by these terms. The six basic shades; red, yellow, green, cyan, blue and magenta, are arranged in a hexagon around the colour white. Together with the colour black, this makes a hexagonal structure. The colour tone H gives the angle, beginning at 0° for red, through to 180° for cyan and to 270° for magenta. The saturation value S is always measured radially from the outside. Inside, on the black/white axis, the value S is 0.0. Outside, on the edge of the hexagon, this value is 1.0. The greater the saturation, the more saturated (or intense) the colour tone is. But the colour tone isn't changed if you only alter the saturation. Finally, the shade value V is measured along the black-white axis. At the top (white), V has the value 1.0 which changes continuously downwards until it reaches black, with the value 0.0. You can darken a colour tone using this control.

Summarising

- The pure colour pigments can be found at the edge of the hexagon at $S=1$ and $V=1$.
- A paler shade can be added by lowering the S value (saturation).
- A darker shade can be added by reducing the V value (shading).

16. Materials and Textures

In Cinema4D you can give every object a material. The name of this material can be seen in the “Information” window on the parameter page. If you want to choose a new material you can click on the “Material” button. Alternatively, you can also use the “Select Material” function in the Edit menu (cf. Reference V.2.8).

Newly created objects have the standard white material assigned automatically by Cinema4D.

Materials can also contain textures. Textures are pictures which can be wrapped (or projected) onto an object in various ways. To put a texture into a material, all you need do is enter its filename into the material edit window.

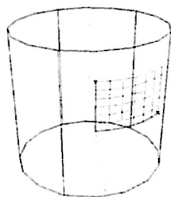
Cinema4D has three different projection methods: flat, cylindrical and spherical.

- In flat projection, the texture picture is projected orthogonally onto the object in its own plane (Pictures 25 and 26).
- The cylindrical projection is a cross between flat and spherical projection (Pictures 27 and 28). It's best used on rotationally symmetrical objects (such as a cylinder or lathed object). You could use cylindrical projection to put a label on a can for instance.

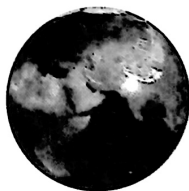
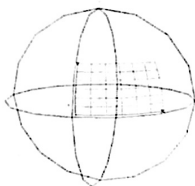
- The spherical projection method wraps the texture picture around a sphere over the object (Pictures 29 and 30). It can be used to transform a rectangular map of the world into a globe of the earth.



Picture 25 + 26



Picture 27 + 28



Picture 29 + 30

Normally you will want to wrap a texture simply (1x) onto the surface of an object. However, for many objects, such as the Ground, you will want the texture to appear more than once. You can do this by activating the "Tile Texture" button (cf. Reference III.4). The texture will then be projected repeatedly onto the object so that it is fully covered by the texture (Picture 31). The texture will be wrapped seamlessly.



Picture 31

As the texture is wrapped, it isn't fixed with the material. Should you need to, the texture can be fixed using the texture toolbar.

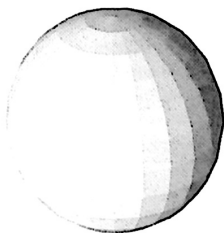
To position a texture, you have to activate the "Edit Texture" button in the main toolbar. The texture for the active object will then be displayed and can be moved and changed in real-time.

The separation between texture data, which is always saved with the object, and material data, which can be found in a material list has been deliberately chosen. The reason for this follows.

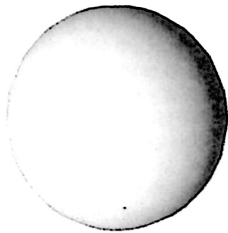
Place yourself, as an example, in a scene with a sphere, a cylinder and a cube. Each of these objects should have different settings for the texture; a spherical projection for the sphere, a cylindrical projection for the cylinder and a flat projection for the cube. You could now give them all the same texture, without having to recreate three new materials.

17. Smoothing

“Smoothing” or Phong shading as it is known, is a function included with Cinema4D that gives an object consisting of three- or four-sided faces a rounded, smoothed look when rendered. For example, a sphere made from a hundred triangles normally appears faceted when rendered (Picture 32), but, if you turn on smoothing, the results are barely discernible from a perfect sphere (picture 33). The quality difference can only be seen around the edges of the sphere which, unlike the mathematically perfect sphere, are still angular.



Picture 32



Picture 33

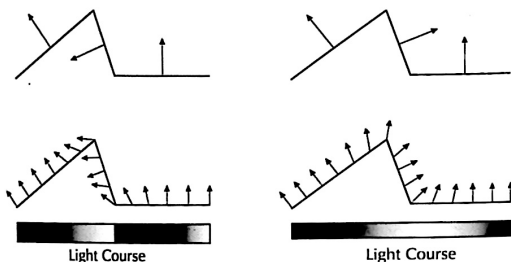
“Smoothing” is a great method for freeing up loads of render time and memory. Traditionally, to create a round object, it had to be subdivided into several thousand triangles to look round. However, smoothing can only be used on objects that have both faces which connect to each other, and share the same points.

“Smoothing” works along the following principles:

During rendering, each face which is lit has a normal created from the corner points of the face. From these corners, and with the rays from the camera and light source, the brightness and colour of a point can be determined.

Normally, when two faces meet there is a hard edge, because each face has a unique normal. At this edge there is a jump in brightness.

With the “Smooth” option activated, the jump in brightness and colour between the two normals is interpolated. This interpolation results in a graduation from the normal on one face to the normal on the other face, thus creating a smooth progression.



Picture 34

During rendering without “Smoothing” it is unimportant whether the normal is on either side of a face. But if it is going to be interpolated, then it is extremely important that the normals are correctly aligned. On the left-hand side of Picture 34 you will see two intersecting faces, which have their normals one way up then the other (staying perpendicular to the face the whole time). You can see the differing result. The interpolated vectors open on one side then the other. What you get is an ugly set of shadows and highlights on the illuminated surface. This causes your object to be smoothed in the wrong areas, thus distorting the rendered object.

On the right-hand side of Picture 34, you can see that everything is as it should be. The normals for the faces are all drawn on one side and lean so that the interpolation can make it seem as though the surface really is curved. This can be used to give objects a more plastic appearance as it creates a smoother blend of brightness'.

It is therefore important that for smoothing to work, you must ensure that all normals for an object are uniformly drawn on the outside or on one side of that object. New objects are created with correctly oriented normals and they shouldn't be edited.

18. Picture Output

If you want to know your monitor's aspect ratio, you need only measure the width and height of the visible monitor picture. The ratio of the two values determines the aspect ratio for your screenmode.

Special attention was paid to the correct output of rendered pictures in the development of Cinema4D. One important concept for this is the aspect ratio. This determines the ratio between the visible width and visible height of the monitor picture. Normally, the ratio is 4:3, you will be able to check if your aspect ratio is correct by creating a circle. If the circle looks elliptical, then this is a sure sign that the aspect ratio is out. When setting the aspect ratio, be sure to bear in mind any screen border, don't just measure the tube area - measure the displayed area. Once the aspect ratio is set up correctly, you shouldn't have any problems with objects being distorted.

This concept is also retained for the perspective display: if you reduce a picture to half its original Y height, then you will see a smaller section of the Y axis of the scene, but it will be completely undistorted. The rendered picture is then, to all intents and purposes, rendered in a wide-screen format. The output follows the rule that the full picture width set in the editor is always visible. The height of the picture is then adapted to fit the aspect ratio.

Warning: This can also have unexpected results. For example, it is often the case that an object is fully visible in the Y axis (or height) of the editor window, but when rendered, a portion of the object lies outside the edge of the picture. Before you start a lengthy render, it is always a good idea to perform a test render in Wireframe using the same screenmode and aspect ratio.

19. A Method for Working

We recommend the following method of working for building complicated scenes:

1. First, build the objects.
2. Group the objects, if necessary, in a hierarchy.
3. Place the objects in the correct positions in 3D space.
4. Build the necessary materials.
5. Put whatever textures you have made onto the objects.
6. Define the necessary light sources for your scene.
7. Check the scene is okay with a quick test render.
8. Only then should you render the scene in the highest quality and resolution.
9. And finally, animate the scene if required.

If you try to follow these guidelines then you will save yourself an awful lot of time.

20. Animation

Cinema4D lets you put together huge, highly complex animations. To help you in this task, Cinema4D offers a wide range of tools and effects to allow you to build almost any imaginable animation.

Unlike many other ray-tracing packages, Cinema4D has no concept of an animation mode - with Cinema4D you just use the normal editor. This method means you retain the concept of non-modal windows and the asynchronous method of working. So if you change a parameter and want to see the result, you can do - no need to reload an editor.

The individual animation functions are explained fully in the Reference section, while a helpful guide, with examples, to animation is in the animation tutorial.

20.1 Keyframe Animation

This is the simplest form of animation in Cinema4D, it works by recording the points in space and time of an object. Cinema4D then generates an animation by interpolating between each points. Using this animation type, you can build animations quickly and easily. For example, you could position an object on screen and record its point in space and time by clicking the “Time” window’s Record button. This stores the position, size and location in time as a keyframe (or key).

Once you have entered more keys, Cinema4D then interpolates between them. For example, if you have a man walking, it is enough to simply put a key at each step the man takes. Cinema4D will then calculate as many in-between steps as you require.

Two keys are enough to make a complete - if rather boring - animation. With three or more keys, you can start to use the other four interpolation types instead of just the basic linear type (cf. Basics 13.).

20.2 Keys, Sequences, Tracks and Blocks

When one or more keys are put together they make a sequence. Sequences are timespans which use only a particular interpolation method. If an object is outside a particular timespan (or sequence), then it is not possible for the object to move. For example, imagine a position sequence in the timespan between 5 to 8 seconds. All the keys for this sequence must lie within these limits, and any interpolation within the sequence will use the selected interpolation method (e.g. B-Spline).

If you're still not sure what benefits several sequences can bring, then imagine the Enterprise. It should accelerate from outside the frame and fly into the camera's field of view. Suddenly, a Klingon spaceship dives down and the Enterprise is forced to brake to a standstill. After a few seconds it becomes clear that the Klingons are not hostile and so the Enterprise flies on its merry way.

For this hypothetical animation you would need two sequences: one in which the Enterprise reaches a standstill, and a second where it starts to accelerate again. If you were to only put down one sequence, then it wouldn't be possible for the Enterprise to stop still. The reason for this is due to the fact that all the interpolation types, apart from linear or jump, tend to either over- or under-swing. In our particular case, this would mean that the Enterprise would jiggle about restlessly. For the moment however, you don't need to worry about the sequences in keyframe animation as Cinema4D will automatically lay them down for you.

If you need to split a sequence into two or more, parts, then this can be done from the "Time Line" window (cf. Reference V.7).

The next unit higher than a sequence is a track. A track contains all the sequences of a particular type. There are tracks for the position, size, direction, materials, textures and special effects. Each track has its own line in the "Time Line" window, on which its keys are displayed.

Finally, there is the block, this gathers all the tracks together as a single unit.

20.3 Path Animation

In many cases, it is often simpler to create a path for the objects to follow rather than setting individual keys. Cinema4D makes this extremely easy as you can use any sort of polygon as the basis for a motion path.

For instance, should you want to make a car drive along a winding road, all you need do is use the same polygon you used to create the road as the motion path for the car. The car will then move along the road in the finished animation.

You can also use additional functions to ensure that wheels of the car spin, and that the body of the car turns at a tangent to the path. Without this, you would get a rather bizarre effect of the car slithering around every corner at the same angle.

In addition you can define realistic acceleration and braking motions, so that the car brakes into a curve and accelerates out of it.

20.4 Hierarchy Animation

Probably the most important aspect of generating realistic animations is the ability to use object hierarchies and also animate them.

Every object in Cinema4D can be animated, either through keyframe or path animation. If an object has sub-objects, then these are normally just moved together with their parent objects.

But you can also animate these sub-objects individually. If a parent object already has a motion that it is going through, then the new motion for the sub-object will be overlaid onto it.

Imagine, if you will, the object “Helicopter”. It consists of two sub-objects; “Fuselage” and “Rotor”. First of all, you can set the “Rotor” object in motion. Then you can set the whole “Helicopter” object on a motion path, such as flying around a building. Thus during the flight, the rotor spins continuously, without you having to adapt its path to that of the helicopter, the reason for this is due to the rotors being contained in the helicopter hierarchy.

Using multiple overlaid animations, encapsulated by hierarchy levels, very complex motions can be performed with minimal effort.

Imagine, for example, a spaceship which begins by pulling in its undercarriage whilst rolling on its longest axis. At the same time a radar dish rotates on top of the ship and the wings pop out in an instant. Individually, these motions are all quite simple, but put them together and you get a highly complex sequence of movements.

One very important fact that you need to remember when making hierarchical animations in Cinema4D is the fact that all animations applied to an object are based on the parent object's axis. Most of the time, you won't even notice this because many objects don't have parent objects and so use the World Coordinates System. So in the case of our helicopter, assume you placed the helicopter in the wrong place in the World Co-ordinate System and you now want to delete it, only without its sub-objects. Immediately, the rotor (and any other sub-objects at the same hierarchy level) "jump" to a new position. What Cinema4D has done is reset the rotor axis to the World Co-ordinate System. And so, the rotor now spins about the World Co-ordinate System's Y axis rather than the helicopter's axis.

In reality, this is purely an internal matter, which, in principle, you should never notice, unless, you alter your object's hierarchy. It is therefore recommended that you create your hierarchies as a first step, and only then start to animate them. If you do it the other way around, you will only be generating extra work for yourself.

This relativity in the hierarchy system is of crucial importance when building polished animations. You can build several independent, animated objects one after the other, then compile them easily. For example, you could create a complete human figure and a train, then animate them separately. It is then perfectly feasible to have the man walking in the train without having to redo any of the animations.

Hierarchical animation is an extremely powerful aid in the production of high quality animations and should be looked at thoroughly.

20.5 Skeletal Animation

When using hierarchical animation for, say, a humanoid figure, it is important that the individual elements - usually arms and legs - don't fall apart. The human body is fortunate in having tissue and bone to hold everything together. However with Cinema4D you don't have either of these so Cinema4D has to use the axes of your objects. Before you can start animating your objects, you must first understand a few guidelines.

Cinema4D lets you place the axis of an object anywhere you like in space. The axis' origin is also the joint point for animation. Therefore, if you make an arm, you only need move the axis to the upper part of the arm, where it will later be used as the joint point. Sub-objects always contain the joint that connects them to their parent object. Cinema4D uses this, in conjunction with the hierarchy, to create the bones of the wireframe.

20.6 Inverse Kinematics

Normally, the position of objects is fixed in keyframe animation by activating the relevant object and moving it as necessary. This result in the object, and all sub-objects hanging off the object, being moved as well. However you will notice that they are moved rigidly, without having any free motion of their own.

Thus if you wanted to animate the arm of the human figure, you would have to go through the time consuming process of moving each object in the hierarchy. Firstly, you have to set the upper arm in the correct position, then the forearm won't be in the right place, unless you're lucky, so you've got to then activate the forearm and rotate it into position. And, of course, now the hand and fingers aren't in the right place, so you've got to activate them all individually, and set them all in the correct position. What a palaver!

All is not lost however, as Cinema4D offers you the use of inverse kinematics. This is a variation on the drag function. This function lets you simply grab a sub-object (like a hand, for instance), and move it. But that's not all, upon dragging the hand, all its parent objects, like the forearm and upper arm, follow the hand's motion automatically. The only limiting factor being how far the object can be stretched within its hierarchy limits.

Using this tool you can breathe life into your synthetic actor. Simply grab his hand and make him get a glass, or put his foot on a step. The options are limitless and the rendered result will always look very natural. As an example, create a figure object (special object menu) and try using inverse kinematics on it.

20.7 Camera Animation

Any complex animation instantly gains extra depth and intensity when camera motions are added to the movements of the objects in a scene. In Cinema4D, the camera is handled just like any other object. This includes the options to use keys and paths for its motion thus opening up a wide range of possibilities. With such flexibility, camera movements through a scene (fly-through), or past objects (fly-by) can be generated in seconds.

One of the possibilities is to target, and fix, the camera onto an object. This means that the object will remain permanently in frame, even when both camera and object are moving. This can be particularly impressive when the camera and object are moving in opposite directions:

In our example animation of the car moving along a road, we could set the camera looking at the car such that as the car nears, it grows larger and larger in the frame. When the car finally passes the camera, we could make the camera pan round to watch the car disappear into the distance.

20.8 Material Animation

This type of animation is extremely interesting for special effects. You can use it to metamorphose one material into another, e.g. change a marble vase into a brass one. This effect can be particularly impressive when you go the whole hog and add a material metamorphosis to an object morph.

Also effective is the “fading-out” of an object. All you need do for this is to raise the transparency value of your material and leave the rest exactly the same. The object will then become progressively more see-through until it completely disappears.

In fact, you can animate nearly all the material parameters in this way, not just colour and transparency.

20.9 Texture Animation

Cinema4D has two types of texture animation. The first of the two runs automatically within a material animation, and is basically a series of pictures which can be cycled through. For example, you could use this feature to create a switched on television. Another possibility would be a sequence of relief textures to create the waves on a sea.

This effect could even be used to produce film like effects, such as placing digitised frames of a real actors face onto computerised bodies, which Cinema4D could then animate.

The second type of texture animation consists simply of the interpolation of the texture axis and texture placement. You could use this to move a texture over the surface of an object.

20.10 Light Animation

In the same way as objects and other bodies, you can also use light sources with keyframe, hierarchy and path animation techniques. Using a hierarchy and binding several lights to one object allows you to build objects such as stadium floodlights.

Cinema4D also allows you to animate all the other light parameters such as colour, range and angle, etc.

20.11 Sun Animation

If you are an architect or landscaper, then you will be thankful for Cinema4D's sun simulation. It lets you realistically reproduce sunlight and shadows over the course of a day.

Cinema4D will render your scene with the correct lighting from a light source whose colour and position correspond to natural sunlight. As your animation progresses, the sun will move through the Sky - just as it does in real life. Thus allowing you to follow the influence of light and shadows on your building project.

Cinema4D also includes algorithms that simulate the atmospheric condition of the sun setting. This results in the sun becoming redder as it nears the horizon.

20.12 Special Effects

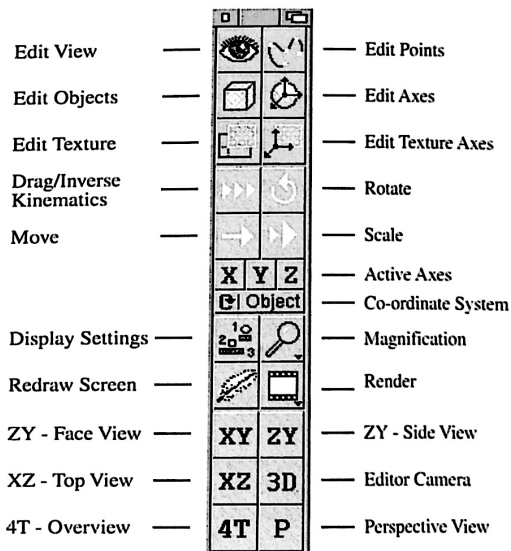
One popular way of making an animation effective is to use special effects, such as exploding or melting an object. Such effects would be very time consuming to generate by hand, this is why Cinema4D includes a wide selection of special effects to choose from. These effects are discussed, in full, in the Reference section of this manual.

Reference

This section covers every function in Cinema4D including all menu, toolbar, and requester functions. This reference section will be invaluable for all Cinema4D users, as well as introducing you to many functions that you have not yet encountered.

The Main Toolbar

The main toolbar contains the most important and most frequently used buttons and functions in Cinema4D. It is subdivided into five sections:



Picture 1

The top six gadgets (Edit View, Edit Points, Edit Objects, Edit Axes, Edit Textures, Edit Texture Axes) determine which sort of object, or which part of an object you can work on. If you click on the "Edit Object" button, you can move, rotate and scale objects. If you click on the "Edit Points" button you will be able to edit the individual points of the object.

Only one of these six gadgets can be activated at any one time. If you choose another one, the old one will be de-selected.

The next four gadgets (Move, Scale, Rotate and Drag/Inverse-Kinematics) are action buttons. They show which action will take place during a mouse action. For instance, a left-right mouse motion can be used to both scale or rotate an object depending upon the selected action gadget.

Again, only one gadget can be selected at any time, and as before, if you click on a different action gadget, the old one will be de-selected. Special input windows are also available for these icons if you right-click or shift-click the icon with your mouse button. In addition to the "X", "Y" and "Z" input fields, there are fields for the "Axis system" and "Transformation". "Axis system" is used to specify whether the transformation is to be entered in World Coordinates, Screen Coordinates or Object (or, when editing textures, texture) Coordinates. For Move and Rotate, only the World Coordinates can be entered as absolute values. Scaling can only be done with local coordinates (object or texture coordinates).

The next group of four icons (X, Y, Z and the axis system cycle gadget) determine how the action will be performed. For example, by deactivating the "X" button, you can ensure that your object can only be acted upon in the Y and Z axes.

The next four gadgets (Display, Magnifying Glass, Redraw and Render), are a collection of frequently used functions.

Finally, there is a group consisting of six buttons (XY, ZY, XZ, 3D, 4T and P), these set the view for the active document window.



1. Edit View

If this button is activated, then any editing you do will only affect the view in the active document window. In the two-dimensional views (XY, ZY, XZ) you can move the displayed section of the interface around or enlarge it, whilst in the three-dimensional views (3D, 4T and P), you can alter the editor or perspective cameras.

Use the mouse to move through space in the following ways:

In Move mode, the camera always moves in the opposite direction to the mouse, that is, if you move the mouse left, the camera will move towards the right, which will make the objects on the screen move over to the left. This is the most intuitive and easy to learn method. Cinema4D also uses the right mouse button so that you aren't just restricted to two-dimensional input. Holding down the right mouse button means that, in addition to moving up, down, left, and right, you can also move forwards and backwards (a left-right mouse movement with the right mouse button held down is interpreted as a forwards-backwards motion). Cinema4D allows you to switch between using the left or right mouse buttons at any point in the editor.

Cinema4D also allows you to cancel any move, scale or rotate function using the <ESC> key.

While moving, you can choose which axis system you want to use for the movement. If you have all three axis button selected, then the setting for the axis system is normally irrelevant. However, if you only have one axis switched on or off, then you will see that your input has varying results. If, for example, you only have the X button activated and you set the axis system to "World", then the camera only moves from left to right parallel to the World Coordinates System. If the axis system is set to "Screen" or "Object", then the camera will only move according to those individual settings.

The camera or visible sections can be freely moved or scaled, regardless of any grid options, i.e. even when the move grid is turned on, you can still set the camera anywhere you like. Should you find yourself in a position where you need the camera snapped to a grid, then you can simply use the perspective camera as an object, thus subjecting it to the same rules as other objects with respect to grid settings.

The Scale function can be used to enlarge the visible area of the scene or reduce it. This is achieved by holding down either of the mouse buttons and moving the mouse left and right.

When Cinema4D is run for the first time, the zoom factor for the orthographic (two-dimensional) views is set to one. For perspective view, it defaults to 50mm, the focal distance of the camera lens. If required, you can alter the focal distance to produce varying levels of distortion. As a rule, the smaller the focal length, the greater the distortion. To avoid any distortion of your scene, you should move the camera rather than changing the focal length. This can be achieved by selecting the move function and dragging the mouse to the left whilst holding down the right mouse button. Give it a go!

The current value for the position, direction and focal length of the camera, or the centre of the visible area of the document, can be found in the "Information" window, on the "View" page. You can also change all the values displayed there directly.

The Rotate function only works when you are working in a perspective view. Two-dimensional views cannot be rotated.

All mouse motions are ordered on a rotational axis system when rotating the perspective view. So a right-left motion with the left mouse button down will rotate the camera about its Y. An up and down motion with the left mouse button pressed will result in the camera rotating about its X axis, while a right-left motion with the right mouse button down will rotate the camera about its Z axis. This function is unusual in that the axis system settings; "World", "Object", and "Screen" behave differently to normal. What happens is that the camera is always rotated on its own axis system unless "World" is chosen. If you choose "World", the camera is only rotated based on its position. What this basically means is that the camera is rotated about the centre point of the screen so that your scene always stays in view - ideal for flying around objects.



2. Edit Points

Activating this gadget allows you to edit the points, edges and faces (the elements) of an object. Once activated, all functions that you carry out will only apply to the points, edges or faces that use those points. In addition, the “Delete”, “Cut”, “Copy” and “Paste” functions from the Edit menu will no longer work on the object.

Upon clicking on the Edit Points gadget, the points that make up a body or polygon will be displayed as small squares. In the Points toolbar you will find the “Element” cycle gadget, using this you can choose whether you are editing the points, edges or faces of an object. As an alternative to this method, you can also use the “Points” item from the Extra menu.

If you choose to edit points, then you can decide which point to edit by clicking on it with the left or right mouse button. All other points will be instantly de-selected. Should you want to select multiple points, you can do this by holding down the shift key while selecting the points. To de-select a point simply click on it once more.

By holding down the <CTRL> key, you can create a frame with the mouse. This works in the same way as dragging a bounding box over icons in Workbench. The only difference is that with Cinema4D you can use either mouse button. You can cancel the bounding box at any time by simply clicking the other mouse button.

The bounding box can be used to select several points at once, and when used in conjunction with the Shift key, allows you to select additional points.

Before executing one of the move, scale or rotate function on a group of points, you must first find a free space near one of the selected points. Since points don't have an axis system, every time you start to move, scale or rotate one of these points, Cinema4D has to create a new axis system. To do this, Cinema4D picks an axis system that lies parallel to the object system with its origin at the middle of the selected points.

The current value and measurement for the centre point of the selected points can be found in the “Information” window, on the “View” page. Should you want to, you can alter the values on this page.

Newly created points will always be set on a grid. The move grid is used for this. You can change the move settings on the view page of the “Information” window.

To add a new point, hold down the <ALT> key while clicking the mouse button. If the new point lies on the connecting line between two existing points, it will be created between them. If not, it will be attached to the end of the line.

As long as the move function is selected, individual points can be grabbed and moved using the mouse. This is especially interesting if you have the “Magnetism” function turned on.

If you have created a new point with the <ALT> key and you decide that the result is not satisfactory, then you can cancel the action by holding down the mouse button again, and hitting the <ESC> key.

If you delete a point, remember that all faces and edges that depended on that point for support will also be deleted.

To delete an active point, you can either use the “Delete” function from the Edit menu (cf. Reference V.2.5), or the or <Backspace> keys.

Let’s summarise:

- ☞ Points can be moved using the “Move” function.
- ☞ You can choose more than one point by holding down the shift key.
- ☞ You can use the <CTRL> key to create a bounding box to select multiple points in the bounded area.
- ☞ You can use the <ALT> key to create new points.
- ☞ Existing points can be deleted using the or <Backspace> keys, or the “Delete” function.

Editing edges works in almost the same way as editing points. You activate an edge by clicking on its end points, one after the other. If there is no edge connecting the two points you have clicked on then nothing is selected, otherwise the edge is selected. Just as with points, you can select more than one edge at a time by holding down the shift key. A bounding box can also be drawn using the <CTRL> key. Edges that lie completely within the bounding box will then be selected. Using the “Tolerance” (cf. Reference V.5.2.9) function, you can also get Cinema4D to choose any edges that have at least one point inside the bounding box.

As with point selection, if you are holding down the shift key and you select an already active edge, it will be de-selected. All other selected edges will however remain unaffected.

To execute one of the move, scale or rotate actions, you must hold the mouse button down in free space near one of the selected points.

If you delete an edge, any faces that depend on that edge will also be deleted.

To create a new edge, you must hold down the <ALT> key and select two already present points one after the other. The new edge will be created between these two points.

To delete a selected edge, simply use the “Delete” function from the Edit menu or the or <Backspace> keys.

Editing faces works like editing edges (and thus, points). You can activate a face by selecting, one after the other, its three corner points. For four-sided faces, you only need select three of the four faces. If the three points you select don’t make a face, then nothing happens. You can select more than one face at once by holding down the shift key. A bounding box can also be dragged out using the <CTRL> key. This method selects all the faces that lie completely within the bounding box unless you have the “Tolerance” option selected (cf. Reference V.5.2.9), in which case any faces which have at least one point inside the bounding box will be selected.

Only polygon-based objects have edges and faces.

You can only edit the edges and faces of this type of object.

If you delete a face, neither its edges nor points will be deleted.

If you are holding down the shift key and you activate a selected face a second time, it will be de-selected. All other faces will remain unaffected.

To execute one of the move, scale or rotate actions, you must hold the mouse button down in free space near one of the selected points.

To create a new face, you must hold down the <ALT> key and select three already present points one after the other. The appropriate edges will be created. You can only create triangular faces, not square ones.

To delete a selected face, simply use the “Delete” function from the Edit menu or the or <Backspace> keys.



3. Edit Objects

Activating this gadget lets you edit your object as a whole. You could, for example, use this mode to move a model of a house, rotate a spline or arrange a light source.

To choose the desired object simply click on its origin point: a click with the left mouse button will select the object with all its sub-objects, but clicking on the origin point with the right mouse button will select only the main object and no sub-objects.

The current position of the object is displayed on the “View” page of the “Information” window. You can edit its position in this window.



4. Edit Axes

The object axis has an important role to play in certain program functions such as “Spline Objects” or hierarchical animation. This lets you set the axis for the object, without actually altering the object itself. This gadget tells Cinema4D that you only want to want to move, rotate or scale the currently active object’s axis.

The current position of the active object's axis is displayed in the window, and can also be edited on the "View" page of the "Information" window.



5. Edit Textures

Using this gadget you can edit the texture on the active object. As soon as you click on this gadget, the active object will be displayed in the same colour as an inactive object. However, the texture will be displayed in white on top of the object. Depending on the wrapping style, the texture will be displayed as a plane, sphere or cylinder (cf. Basics 16).

The texture will be represented by a series of parallel grid lines and its axes will be marked with the letters "X" and "Y". Because a texture is only two-dimensional (a picture has no depth information), there is no "Z" axis.

The texture axes of the object are displayed with a wrapping (a plane, sphere or cylinder) on the surface of the texture which can be moved or scaled using the usual tools. The texture itself cannot be rotated, you have to rotate the texture axis.

With the "Move" function you can place the texture on the wrapping. A left-right movement of the mouse moves the texture along its X axis, whilst an up-down movement moves it along its Y axis. The "Scale" action works on the same principles only that instead of moving, the texture is enlarged or shrunk. Any input using the "Rotate" function is pointless as the texture cannot be rotated.

The current placing and measurement of the texture can be found and edited on the "Position" page of the "Information" window. The three angle fields will be empty because the texture cannot be rotated, the same applies to the Z axis field.

The X and Y entries for the placement and measurement of an axis are always given in percentages because their actual sizes don't matter. A setting of 100% for both axes means that the texture for a cylinder, sphere or plane is completely covered.



6. Edit Texture Axes

Using this gadget, you can edit the texture axis of the active object. As soon as you click on this button, the texture and its wrapping will be overlaid on the object, which will be drawn in the inactive object colour. You can immediately start to move, scale or rotate the wrapping as required.



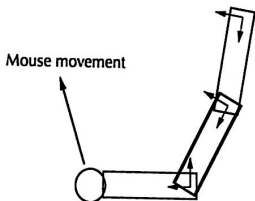
7. Drag Objects

This button offers you the inverse kinematic functions - an easy way of positioning grouped objects. This function can be used to grab the hand of an arm and move it to a specific place. While moving the hand, the arm will also follow the movement of the hand.

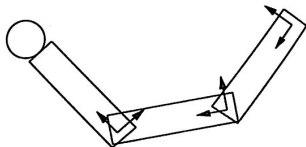
You need to have built an object hierarchy for this function to work.

This “Drag” action doesn’t just have to be used for animation purposes, it can also be used as an excellent tool for normal object construction. The only pre-requisite, however, is that all object are arranged hierarchically.

Whilst dragging, Cinema4D automatically keeps the distance between the joints constant (Picture 2). In this way, an arm with several joints can be dragged without it ever falling apart (Picture 3).



Picture 2



Picture 3

☞ You can learn more about joints in the “Skeletal animation” section of the Basics chapter 20.5.

To “Drag” an object you must first activate the part you want to move. This could be the arm of a robot for instance. If you now click on the “Drag” button and select an area near the arm to drag, Cinema4D will calculate which of the activated objects the mouse click is nearest to. This object can now be “dragged”. All the parent objects in the hierarchy will now follow as you move the selected object with the mouse.

The “Figure” model is particularly useful for trying out the “Drag” function. This object can be found in the special object entry on the Objects menu. It is already organised into hierarchies so that it can be used immediately with the “Drag” function.

When the Drag function is selected with the SHIFT key pressed, a window is opened for you to specify the strength of the effect of the “dragging” on the hierarchy. At 100%, almost all objects in the hierarchy will follow the movement of the mouse, at 10% only the first two or three.



8. Rotation

You can use this function to rotate the active object about its own axis, or that of the screen or world.

You can use the rotation grid to set the number of degrees through which an object can be rotated. For instance, if you only want to rotate an object in 10° steps (e.g. 60°, 70°, 80°, etc.).

Cinema4D distinguishes between the World, Object and Screen Co-ordinate Systems, and so long as your object lies parallel to the World Co-ordinate System, as it does when it is created, then there is no difference between the Object and World Co-ordinate System. However, as soon as the object is set at an angle in space, the difference becomes plainly obvious.

Rotations can be cancelled with the <ESC> key.

If the active object is to be rotated about the World or Screen axis system, the world or screen axis isn’t used, but a parallel axis which passes through the object’s origin point. If this wasn’t the case, the active object would not only be rotated, but at the same time, the origin point of the object’s axis system would also be rotated about the selected world or screen axis.

☞ The difference between the three systems is described in greater detail in Chapter 6 of the Basics section.

At any one time, you can only ever rotate the active object about one axis. Rotation is effected by moving the mouse left and right, regardless of which mouse button is selected. The axis to rotate about is selected by picking one of the “X”, “Y” or “Z” buttons in the main toolbar.

It should be noted that rotating the camera view follows different rules. (cf. Reference I.1).

No matter which rotation system you use, the position of the active object will always be given in the World Co-ordinate System on the “Position” page of the “Information” window.



9. Movement

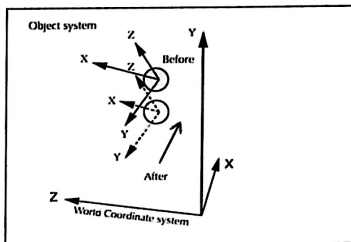
With this function you can position the active object practically anywhere in the work area.

Since Cinema4D differentiates between the World Co-ordinate System, Object Co-ordinate System and the Screen Co-ordinate System, you can use the “Axis System” cycle gadget to set in which of these three systems you would like to move the active object.

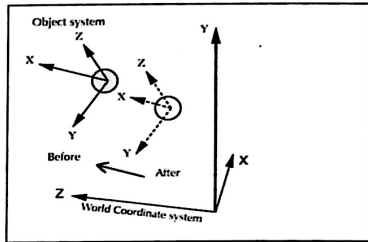
Use the move grid to obtain a higher level of precision when moving an object. This will let you only move the object in 10cm steps, for instance.

The difference between the different axis systems becomes very apparent when you only use the “X” axis for movement. Let us suppose that you have a square crooked to the World Co-ordinate System. When you now move it using the World Co-ordinate System, the square will move parallel to the X axis of the World Co-ordinate System (Picture 4). Should you then choose to move the square using the Object Co-ordinate System, then the square will move along its own X axis (Picture 5). If you now choose the Screen Co-ordinate System to move the square, you will see that it just moves right, across the screen (Picture 6).

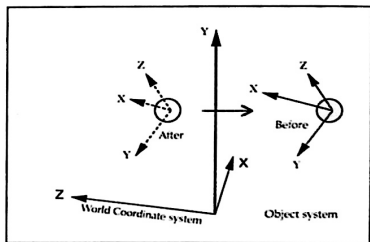
You can use the “X”, “Y” and “Z” axis buttons to lock down certain axes. This is essential when, for instance, you are building an object that stands on the floor. If you want to move it in a perspective view, it might shift in the Y axis, and end up under the floor. If you however lock the “Y” button, then the object will sit solidly on the floor and only move in the other two directions.



Picture 4



Picture 5



Picture 6

A left-right movement of the mouse with the left button held down will move the object on the X axis of the Screen Coordinate System. While an up-down motion moves the object in the Y axis. If you then hold down the right mouse button, and make a left-right motion, the object will move into and out of the screen along the Z axis.

It should be noted that there is a slight change in meaning when it comes to moving textures. Here a left-right mouse movement will move the texture on its X axis, while an up-down motion will move the texture on its Y axis.

As an alternative to moving objects with the mouse, you can also enter movements manually into “Position” page of the “Information” window. All values given in the “Information” window are based on the World Co-ordinate System.



10. Scaling

This gadget lets you make the active object as large, or as small as you like.

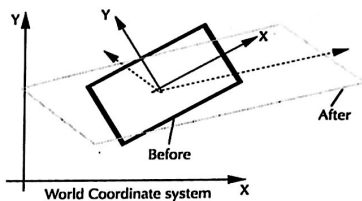
The scale grid is unavailable when you are using either the World or Screen Co-ordinate Systems with one or more of the three axes unlocked.

You can use the scale grid to achieve a higher level of precision when scaling an object. You could, for example, set the grid to only let you scale your objects in jumps of 10cm at a time.

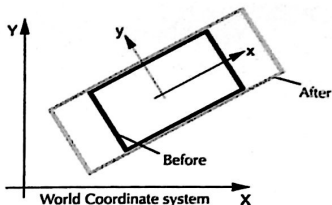
When you are scaling an object, Cinema4D differentiates between the World Co-ordinate System, the Object Co-ordinate System and the Screen Co-ordinate System. You can scale the object in any of the three systems.

The difference between the three is particularly noticeable when you only have the “X” axis activated. Let us suppose you want to scale the same square we used last time, the one that is sitting crooked to the World Co-ordinate System. If you choose to scale it on the World Co-ordinate System, then the square will be stretched parallel to the World Co-ordinate System’s X axis and will thus be distorted (Picture 7). Should you choose the Object Co-ordinate System, then the square will be enlarged along its own X axis (Picture 8).

As we have just seen, scaling can distort an object. This will always occur when you are using the World or Screen Co-ordinate System, and, when you have one or more of the axes unlocked. In this scenario, the object’s axis will remain unaltered. This is necessary to preserve the right angle of the axis, this is also the reason why the scale grid has no function.



Picture 7



Picture 8

To switch between the different axis systems, hit the “Axis system” button. You can lock off certain axes which will mean that you only enlarge or reduce your object in one direction.

Scaling is done by moving the mouse using a left-right motion with either mouse button selected.

There is a slight difference when scaling a texture. Here a left-right motion scales the texture on its X axis while an up-down one scales the texture on its Y axis.

You can also set the values for scaling on the “Position” page of the “Information” window.



11. X, Y, Z

These three gadgets let you lock the axes about which you wish to move, rotate or scale objects.

Points, objects, object axes and texture axes can only ever be rotated about one axis at a time. Only the camera can be rotated about all three axes at once.

Cinema4D notes the settings for these three buttons for each different action, so that you can move an object on the X axis only, then switch to rotate and it will already be set so that you can rotate the same object on its Y axis.

 World

 Object

 Screen

12. Axis System

Here you set in which co-ordinate system an action will take place. You can choose between Screen, Object and World (cf. Basics 6).

The world system primarily serves for positioning objects in a scene. The object system is great for scaling your objects, and the screen system simplifies working with the editor camera. The system you choose to use depends entirely on the individual case. Try them all out to get a feel for their different methods of working.

If you have all the axes activated, then, as a rule, there isn't much of a noticeable difference between the three systems. Its only when you come to have one or two of the axes unlocked that the differences become really apparent.

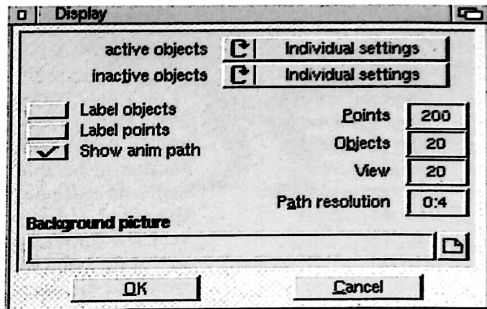
Cinema4D uses the co-ordinates for the screen from the Screen axis system. Its X axis always proceeds from the centre of the screen to the right, its Y axis goes from the centre point upwards and its Z axis goes "inwards" from the centre point.



13. Display

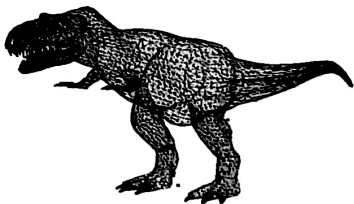
This is where you can set how your objects look on screen. In addition, you can activate labels for your objects and points.

Cinema4D also offers you the chance to speed up the screen redraw by allowing you to set the following global preferences for all active and inactive objects in your scene.



Picture 9

- If you choose “Maximum Detail”, then the object will be drawn with all its lines (Picture 10). This results in a normal speed screen update.

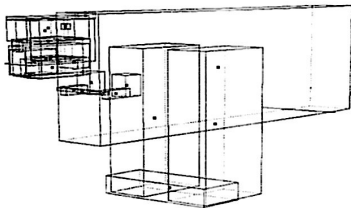


Picture 10

- Using the “Bounding Box” setting, all objects will be represented by empty boxes. This speeds up screen update enormously. It means that an object consisting of hundreds of lines can now be represented by just twelve lines (Picture 11). This display style is primarily used for the purpose of animation previews.

You can save these settings using the "Save Display Prefs As" item in the Project menu. It is also possible to save these settings as defaults for the program.

- If you don't need the exacting display that "Maximum Detail" provides, you can step down levels by using "High Detail" (Picture 12), "Medium Detail" (Picture 13) or "Low Detail" (Picture 14). These display only 50% (High), 25% (Medium) or 10% (Low) of all the lines in an object which, especially for an irregular object like a dinosaur, is enough to be able to recognise the outline of the shape easily. In extreme cases this can give a tenfold increase in the speed of the screen update. Because an object with very few lines would become practically invisible if set to any of the reduced settings - a cube with only twelve edges would be displayed as one line if set to "Low Detail" - the reduction steps only work when objects have 30, or more, lines.



Picture 11

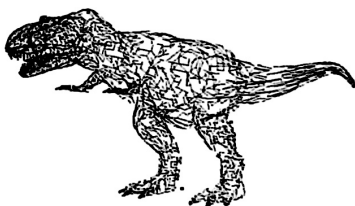
The "Invisible" setting is particularly useful for when you want to fade out an object for a time and have less lines on the screen.

- If you choose "Invisible", then your object will not be displayed at all, although it is still available.
- You can set each individual object's display preferences on the "Object" page of the "Information" window. When you want to use these individual object settings choose "Display".

An objects origin point is always displayed - regardless of the display settings.



Picture 12: High Detail



Picture 13: Medium Detail



Picture 14: Low Detail

Because unaccelerated Amigas can be very slow, you can set a maximum number of points and objects for interactive input so that several thousand lines can be displayed in real time on your screen. Any elements over this number will not be displayed.

- The number of points displayed when moving can be set in the “Points” field.
- When you move the active object it is normally shown as a bounding box, along with its sub-objects. The “Object” field determines how many bounding boxes your computer can display in real time. If more objects are going to be moved than the display can handle in real time, Cinema4D sets which ones should be culled according to their position in the hierarchy. As a rule, the higher they are, the more likely they are to be displayed. A random generator makes certain that, where possible, the outline of the object is visible.
- You can also set how many bounding boxes are displayed in the “View” field. This sets how many objects are displayed when the whole scene is moved (when the camera is moved), a high value is therefore not a good idea. Try this one out to find the best setting for your Amiga.

There are two label functions in Cinema4D. One is “Label Object”. With this option activated, each object on the interface will have its name overlaid on it. The other is “Label Points” which numbers each point in the active object, this will only occur when in the Edit Point mode.

“Show Anim Path” sets whether or not the motion path for the active object is visible.

A numerical value is entered in the “Path resolution” field. This defines how detailed an animation path is to be drawn. It consists of the number of frames after which another path point is to be calculated. Lower settings (> 1 frame) lead to significantly faster drawing of the animation path.

You can use the “Background Picture” field to put a picture in the background of the interface. This is particularly useful should you ever want to trace a logo or contour lines from a map. Either enter the path and filename of the IFF file, or use the file button to open a file requester for you to locate a file.

The picture should be monochrome. If it contains more colours, then Cinema4D will only use the first bitplane from the picture.

The size of the picture is not altered by Cinema4D. So, if it is too big for the document window you will see a cropped section, if it's too small, then it will be centred in the screen.



14. Magnifying Glass

If you click on this gadget a pop up menu will appear with several options.

14.1 Magnifying Glass

You can use the magnifying glass to enlarge a section of the scene, by framing the area with the mouse.

As soon as you choose this option the mouse pointer will change from an arrow into a crosshair. Now you can frame the area you want in the document window. This framing works identically to Workbench, only it doesn't matter which mouse button you use. You can cancel the bounding box at any time by clicking the other mouse button.

14.2 Zoom in

This function enlarges the display by 25%. If you are using the 4T view, the mouse pointer will change to a question mark. You can then select whether you want to enlarge the perspective view or one of the orthographic views by clicking in the appropriate quadrant.

14.3 Zoom out

This function shrinks the display by 25%. If you are using the 4T view, the mouse pointer will change to a question mark. You can then select whether you want to shrink the perspective view or one of the orthographic views by clicking in the appropriate quadrant.

14.4 Active Object

Sets the visible portion of the display so that the active object is fully visible and centred in the display.

In the Perspective view, the camera will move parallel. Its point of view will not change. If you are using the 4T view, the mouse pointer will change to a question mark. You can then select whether you want to use the perspective view or the orthographic views by clicking in the appropriate quadrant.

14.5 Whole Scene

If you need an overview of the entire scene, you can use this function. It sets the visible section of the interface so that the entire scene is centred and fully visible in the document window.

The camera however will only be moved parallel to its original facing in the Perspective view. Its point of view will not be changed. If you are using the 4T view, the mouse pointer will change to a question mark. You can then select whether you want to change the perspective view or the orthographic views by clicking in the appropriate quadrant.

14.6 Original Size

This function will reset the scale factor back to 1.0 or the focal length of the camera back to 50mm if you are using the Perspective view. These are the default values at the start of the program.

If you are using the 4T view, the mouse pointer will change to a question mark. You can then select whether you want to change the perspective view or the orthographic views by clicking in the appropriate quadrant.



15. Redraw

Clicking on this button will redraw the entire scene.



16. Rendering

This button covers all functions relating to the rendering of pictures. The functions are arranged in order of rendering time and picture quality.

If you click on the “Render Picture” button, you will see that a pop up menu appears from which you can select the desired rendering method.

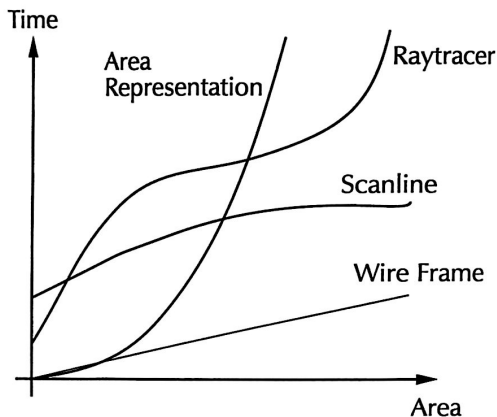
If you use the left mouse button to choose your render method, then rendering will commence immediately using the default settings. If, however, you use the right mouse button, a settings window will appear into which you can enter various render parameters, along with the name of the finished render.

Picture 15 shows the time differences between the various rendering methods.

As you can see, “Wireframe” mode needs the least amount of time to render, in fact, the amount of time needed to output the lines to the screen becomes the most significant factor. Since the wireframe rendering times are linearly dependant on the number of faces in the scene, this means that users of high speed graphics cards will enjoy very fast output times.

The rendering time of a “Faceted” screen is affected by the sorting algorithm which, in spite of optimisation, increases the time taken exponentially depending on the number of faces to be rendered. Rendering in this mode therefore becomes impractical when rendering scenes with more than a hundred thousand faces.

The active document is always the scene that is rendered. The only things that will appear in your picture will be objects. Splines, the camera and lights won't be displayed, they are only used for the creation of the rendered image.



Picture 15

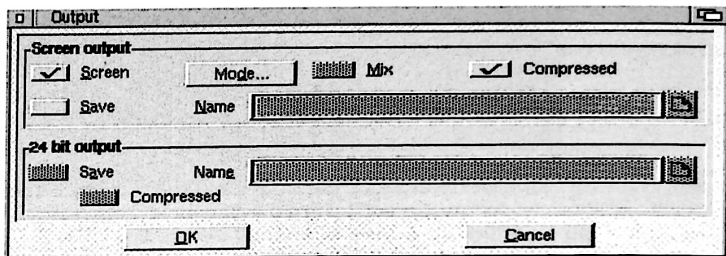
In comparison, the rendering mode known as “Scanline” is largely constant. Its speed mainly depends on screen resolution. In general, the more pixels there are, the more calculations have to be carried out for the lighting of objects. Even with more detailed objects, the offset between number of faces and size of the faces is fairly constant. The result of which means that the scanline algorithm is ideally suited to animation.

“Ray-tracing” is not however so simple. The more faces that need to be rendered, the more time the algorithm needs. However, Cinema4D has a scanline algorithm integrated into its ray-tracing program (the adaptive ray-tracer). This comes into play whenever ray-tracing is not required in a picture (i.e. no transparency, no shades etc.). Thus, depending on the scene, the exponential increase in render time may or may not be seen.

The two windows “Output” and “Progress” are common to all processes. The “Output” window is opened by clicking on the “Output” button in the settings. The “Progress” window appears on the editor screen while a picture is being rendered.

Output Window

The “Output” window is divided into two parts: one for screen and one for 24-bit output.

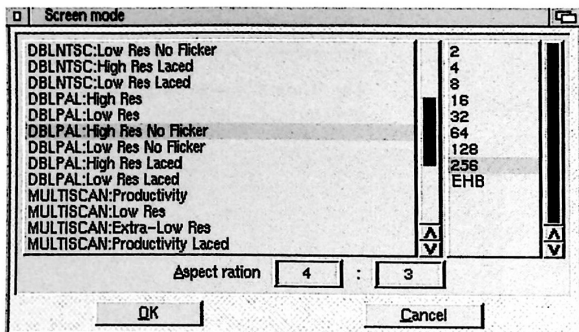


Picture 15

Screen Output

Here you decide whether the picture is to be output to the screen at all. This is essential for the wireframe and surface display but can be disabled for the scanline or raytracing processes. Instead, you need to activate the 24-bit display since the rendering of a picture without output to either the screen or the hard disk makes no sense.

Under “Mode” you select the desired screen mode (cf. Basics 18.). The first entry in the list of selections is always “Cinema screen”. If this is selected, the picture will be rendered on the Cinema4D editor screen. This setting is generally preferable since there is no need to open a new screen. But there are also drawbacks. The editor, for example, occupies the first eight screen colours, thus giving a lower picture quality. The best option is to use the picture only as a preview and to have it output simultaneously to the hard disk as a 24-bit file. If the editor is used in “HAM-8” mode, of course, the pictures will be output at a very high quality.



Picture 16

For animations, the output should always be redirected to a separate screen because output to a window on the editor screen imposes more demands on the Amiga operating system and therefore slows down the process. Since these delays can easily build up over an animation you should therefore use a separate screen.

In addition, you can set the picture aspect ration (cf. Basics 18.) under "Mode".

If you select "Save", the picture will be saved under the path name indicated in the "name" text field. "Compressed" is used to determine if the saved IFF picture is to be compressed.

With many graphics cards, you can see stripes or patterns in colour transitions despite the 24-bit mode. Such graphics cards cannot accurately display colour transitions. In order to reduce this problem in soft colour transitions, Cinema4D uses dithering even with 16 million colours. It should be noted that dithering only applies to the screen and not to the hard disk output.

24-bit Output

Each picture is rendered internally at 16 million colours (24 bits). A normal Amiga cannot display so many colours but can only save them. To do this, enter the pathname under which the picture is to be saved with all its 16 million colours in the “Save” field.

“Compressed” is used to determine if the 24-bit picture is to be saved in compressed form.

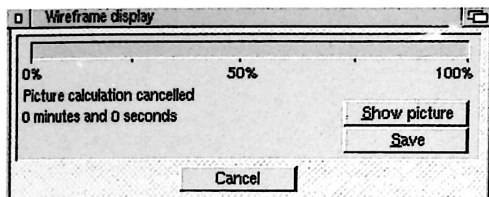
Even if you do not own a graphics card, it is a good idea to save the pictures with 16 million colours to begin with, and then use a suitable utility in order to convert them to the Amiga colour resolution. This achieves a better picture quality than outputting it straight to the screen.

For certain output devices (colour slides, for example), you need to define the aspect ratio. Cinema4D always uses the ration indicated under “Mode”, even if no output is actually generated.

The Progress Window

When the processing of the picture begins, the “Progress” window appears to indicate how far the calculation has advanced. It is normally hidden behind the output screen, but can be brought to the foreground by clicking on the output screen. Another click on the “Picture” field returns the output screen to the foreground. You can also switch between the two screens with the short-cut key “P”.

The rendering of the picture can be aborted by either clicking on “Cancel” or pressing the <ESC> key. If the rendering is still in progress, you will be prompted for confirmation after pressing <ESC>.



Picture 17

The output screen can be saved as an IFF picture at any time with "Save". You will be prompted for a filename under which the picture is to be saved. Hence you can save the picture even if you had forgotten to activate the "Save" option in the "Output" window.

16.1 Monochrome Wireframe Display

This method of display is much the same as the Wireframe display, the only difference being that the scene is drawn in black-and-white only.

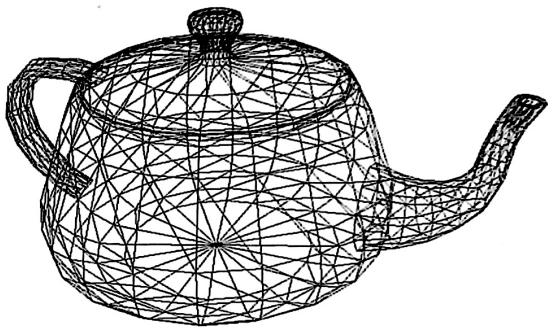
The monochrome display is perfectly suited to the testing of animations. Animations which have been rendered in the monochrome Wireframe display can be run directly in the editor using the "Play" function in the "Keyframe" menu (cf. Reference V.6.).

16.2 Wireframe Display

Here all lines in the objects are drawn, similar to the 3D view (Picture 18). Output is to a separate screen. Unless monochrome is selected, Cinema4D will select those colours from the available ones which approximate the objects' material colours most closely.

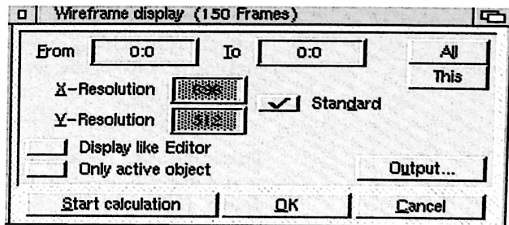
The Wireframe display is particularly useful for a quick overview of the scene, especially with animations, since the rendering is extremely fast.

When the picture is output with very few colours, there can be considerable differences between the actual and the used colours.



Picture 18

The base is drawn as a horizontal line only. The Sky is drawn only when there are more than two colours, by setting the screen background to the closest colour. Spheres are drawn as Wireframes, unlike in 3D view.



Picture 19

This

If "This" is selected, the picture currently shown by the Perspective camera is rendered.

All

If “All” is selected, the entire animation time of the active document is rendered.

From, To

If you only wish to render part of the animation, you can enter here the picture numbers to be rendered. You can, for example, use this to resume interrupted renderings. The first picture is numbered 0.

If you do not want to render an animation, enter the value 0 into the “From” and “To” fields.

Please note that animations always require you to enter a pathname under which the pictures will be saved. A full stop and a four-digit picture number are appended to the name of each picture (e.g. “Pic.0021”).

X-Resolution, Y-Resolution

The X and Y resolutions of the picture are freely definable. If the selected resolution exceeds that which the screen can display, only a part of the picture will be shown. You can view the other parts by moving the mouse to the screen edges, whereby the visible section is moved.

Standard

Activate this field in order to generate full-format output. The alternative is to set the resolution manually.

Block Display

This option can be used to further accelerate the output. Instead of the many lines of an object, only the surrounding block is drawn, indicating the size and orientation of the object. This function has nothing to do with the “Display” function in the main toolbar, since the latter affects only the editor display.

Active Object Only

When this option is activated, only the active object is drawn. All other objects including Ground and Sky are not shown.

Output

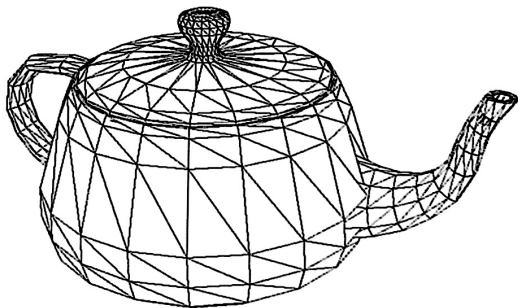
When you click on this field, the “Output” window appears, in which you enter details on the type of picture output (cf. Basics 18.).

Start Rendering

Starts the rendering of the picture, taking into account the entered values.

16.3 Monochrome Shaded Display

This display mode is much the same as the shaded display, the only difference being that the scene is drawn in black-and-white only (Picture 20).

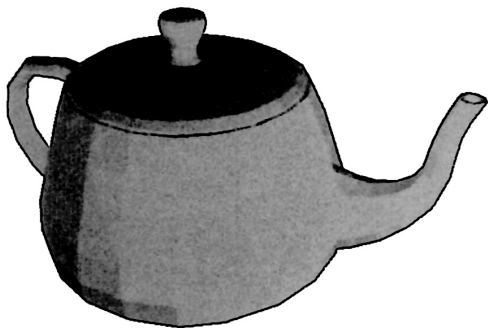


Picture 20

The monochrome shaded display is ideal for the testing of animations. Animations which have been rendered with the monochrome shaded display can be run directly in the editor using the “Play” function” in the “Keyframe” menu (cf. Reference V.6.).

16.4 Shaded Display

The shaded display is more realistic than the Wireframe display because it only outputs the visible surfaces and not the hidden lines (Picture 21). In addition, the visible surfaces are shaded when more than two colours are used. Only one colour is used per surface thereby producing a somewhat coarse picture without reflections.



Picture 21

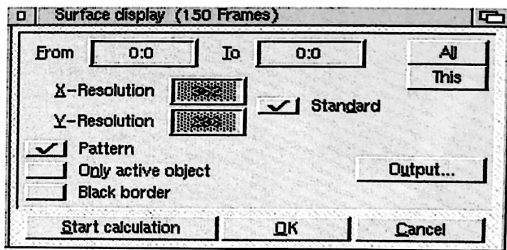
To suppress the hidden lines, Cinema4D sorts all surfaces of the scene from the back (maximum distance from the camera) to the front (nearest the camera). Then the program starts output in the same sequence. The most distant surface is drawn first, then the second most distant and so on, until the nearest surface is reached. Foreground surfaces cover the previously drawn surfaces automatically.

There are problems in rendering the hidden lines. Imagine two mutually penetrating surfaces. Whichever Cinema4D draws first, the result will not be the desired picture. The shaded display cannot solve such problems, which is what the scanline algorithm exists for.

Sorting the surfaces takes a certain time. The shaded display is always slower than Wireframe.

This mode of rendering is particularly suited to a rough overview of the spatial arrangements of the objects in a scene. Due to the algorithm used, however, it is impossible to render reflections, transparencies and shadows. Nor are textures displayed.

Cinema4D features automatic lighting. If you have not as yet defined a light source, Cinema4D will render the scene using a standard light source located in the same position as the "Perspective" camera. Thus you can view objects in good light while constructing them. However, as soon as you define one or more normal light sources, the automatic lighting is disabled unless you have disabled it anyway in the editor settings.



Picture 22

From, To

If you only wish to render part of an animation, you can enter here the picture numbers to be rendered. You can, for example, use this to resume interrupted picture rendering. The first picture is numbered 0.

Please note that you must always enter a pathname for animations, under which the pictures will be saved. A full stop and a four-digit picture number are appended to the picture name (e.g. "Picture.0001").

X-Resolution, Y-Resolution

The X and Y resolutions of the picture are freely definable. If the selected resolution exceeds that which the screen can display, only a part of the picture will be shown. You can view the other parts by moving the mouse to the screen edges, whereby the visible section is moved.

Standard

Activate this field in order to generate full-format output. The alternative is to set the resolution manually.

Pattern

When this option is activated, Cinema4D will use patterns to fill the surfaces. The addition of such mixed colours greatly improves the picture quality. It may be a good idea to disable these patterns with animations as they can cause "noise" in the picture.

Active Object Only

When this option is activated, only the active object is drawn. All other objects including Ground and Sky are not shown.

Output

When you click on this field, the "Output" window appears, in which you enter details on the type of picture output (cf. Basics 18.).

Start Rendering

Starts the rendering of the picture, taking into account the entered values.

This

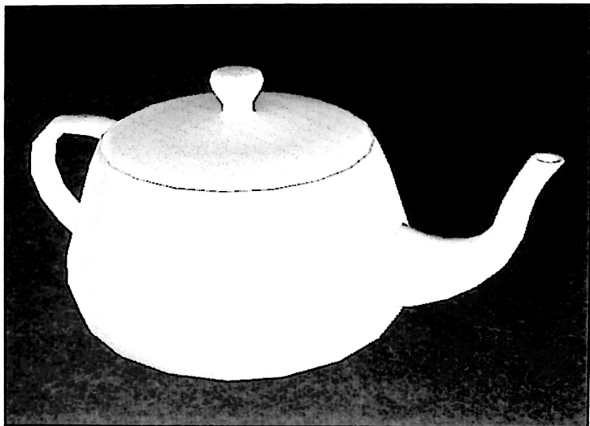
If “This” is selected, the picture currently shown by the Perspective camera is rendered.

All

If “All” is selected, the entire animation time of the active document is rendered.

16.5 Scanline display

An enormous improvement, compared to the shaded display, can be achieved by using the scanline algorithm. This does not sort entire surfaces as with the shaded display, but all points in a surface so that even intersections and overlapping surfaces are correctly displayed (Picture 23).



Picture 23

In addition, the scanline algorithm renders the brightness for each single dot on a surface. It can therefore show realistic transitions from light to dark, reflections and even textures.

Although the scanline algorithm does not perform raytracing, it can still display reflections, Ground, Sky and fog.

Another advantage when compared with the shaded display is the ability to smoothen objects so that they appear rounded.

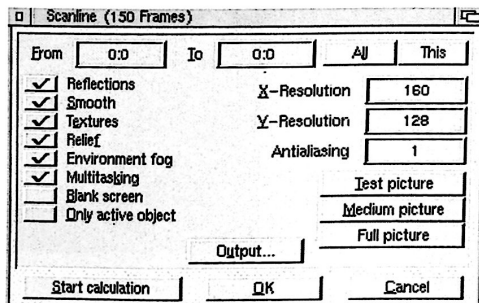
Rendering the picture requires considerable processing power. To reduce the processing time, an intermediate storage area for the depth values of the individual points in a picture line is created. The picture is rendered from top to bottom, line by line - scanned and output, so to speak, hence the name "scanline". A line is displayed as soon as it has been rendered.

Like the shaded display, the scanline algorithm features automatic lighting (cf. Reference V.1.7.1.).

Cinema4D uses a highly optimised scanline algorithm in order to achieve maximum speed. You should use the scanline algorithm primarily when you need to examine the positioning of textures on objects, and when you do not require shades and transparencies in your scene.

The scanline algorithm can display colours, highlights, all textures and reflections of Ground and Sky.

Despite certain restrictions, the scanline algorithm is well suited to the generation of photo realistic pictures and is ideal for animations, where processing times are critical.



Picture 24

From, To

If you only wish to render part of an animation, you can enter here the picture numbers to be rendered. You can, for example, use this to resume interrupted picture renderings. The first picture is numbered 0.

Please note that you must always enter a pathname for animations, under which the pictures will be saved. A full stop and a four-digit picture number are appended to the picture name (e.g. "Picture.0021").

Reflections

Using this option, you can make the scanline algorithm render reflections from Ground and Sky onto the surfaces of reflecting objects. This functions does not require much processing time and is therefore a good alternative to raytracing for time-critical projects.

Smoothing

When this option is activated, objects for which the "Smoothing" option is enabled (cf. Basics 17.) will be displayed smooth ("Phong shading").

Textures

Here you can select if the scanline algorithm is to display the textures used in the scene. Doing without textures accelerates the picture rendering.

Relief

Here you can select if relief textures are to be taken into account. Objects not containing relief textures are unaffected.

Environment Fog

Select if the environment fog - if present - is to be rendered.

Fog objects can only be correctly rendered by the Ray-Tracer. The scanline algorithm displays them opaque.

You can view the picture being rendered at any time by pressing the key combination <Left Amiga> + M. Cinema4D will automatically reset the display to black after a while.

Multitasking

When there are many programs running simultaneously under the Amiga's multitasking, the speed of each program is severely limited. To enable Cinema4D to run full speed when rendering pictures - even when many other programs are active in the computer's main memory - you can disable multitasking during picture rendering by de-selecting the "Multitasking" option.

While multitasking is disabled you cannot move the mouse or enter keyboard input. To enable you to abort the picture rendering, however, multitasking will be briefly resumed after each completed line of rendering. You can then stop the rendering. Pressing the <ESC> key will abort the rendering even more quickly.

Switch off Picture

You can gain a little speed if you select the option "Switch off picture". The screen is then set to black for the duration of the rendering. Processing is speeded up a little by the fact that the computer does not need any processing power for the picture display. This does not apply, however, to the screen modes of graphics cards, where this option has no effect.

Active Object Only

When this option is activated, only the active object is drawn. All other objects including Ground and Sky are not shown.

X-Resolution, Y-Resolution

The X and Y resolutions of the picture are freely definable. You can select common resolutions of 320*256 pixels as well as 36000*24000 pixels (slides).

If the selected resolution exceeds that which the screen can display, only a part of the picture will be shown. You can view the other parts by moving the mouse to the screen edges, whereby the visible section is moved.

You can also select smaller resolutions such as, 80*64 pixels, even though the “Output” has a resolution of 320*256 pixels. The picture rendered will occupy less space on the screen and will be displayed in the top left corner.

Anti-Aliasing

Since a picture is always made up of pixels, it has a coarse structure which is the more noticeable at lower resolutions. This can be seen particularly clearly at the edges of faces where many small steps (the individual pixels) appear rather than a straight edge. This phenomenon is known as aliasing.

Cinema4D features an “anti-aliasing” setting to remove this. If you enter a value greater than 1, the picture is rendered in a higher resolution than the one specified, thus enabling Cinema4D to extrapolate several pixels from one screen pixel and automatically inserting extra pixels at edges to smooth out the steps. The picture as a whole looks much better, details are more visible and irritating moiré patterns are reduced or even eliminated.

The processing time will increase with anti-aliasing enabled, as several pixels are now calculated and averaged instead of one. At an anti-aliasing level of n , n^2 pixels are calculated. Processing time will not, however, increase by a factor of n^2 as Cinema4D employs a highly optimised scanline algorithm. As a rule, processing time will only be tripled at a setting of 2.

Test Picture, Medium Picture, Full Picture

For testing purposes, it is advisable to have the scene rendered at a low resolution (e.g. stamp sized).

To avoid having to fiddle with the correct resolutions and settings every time, you can use the functions “Test picture”, “Medium picture” and “Full picture”. When you select these fields, Cinema4D will automatically set the correct resolutions for a small, a medium or full-screen picture. The appropriate settings are also made at the same time. For a full picture, for example, all the high quality options are activated, while for a test picture most options are disabled in order to maximise the processing speed.

The processing time is proportional to the pixel resolution. Twice as many pixels need twice as much processing time. But remember that doubling the X and Y resolutions results in quadrupling the picture resolution.

Output

When you click on this field, the “Output” window appears, in which you enter details on the type of picture output (cf. Basics 18.).

Start Rendering

Starts the rendering of the picture, taking into account the entered values.

This

If “This” is selected, the picture currently shown by the Perspective camera is rendered.

All

If “All” is selected, the entire animation time of the active document is rendered.

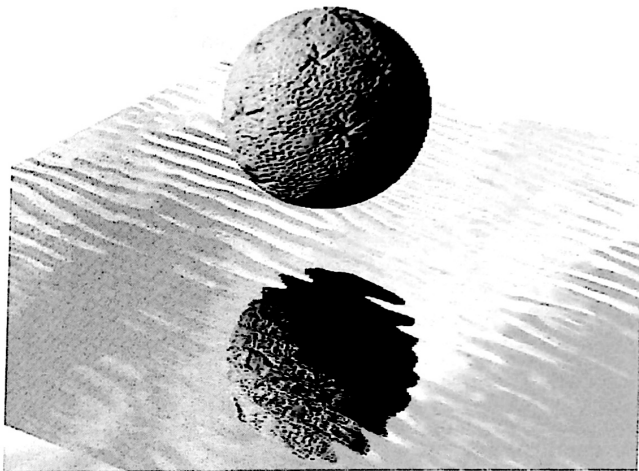
The Ray-Tracer, like the shaded display and the scanline algorithm, features automatic lighting (cf. Reference V.1.7.1.).

16.6 Ray-Trace

This method of picture rendering offers you the best-available picture quality (Picture 25). All properties such as shadows, transparency, reflection, textures, relief, smoothing and fog are rendered and displayed.

The Cinema4D Ray-Tracer is an adaptive Ray-Tracer, i.e. it automatically renders those parts of a picture where the raytracing process is required. Everywhere else it employs an integrated scanline algorithm. If a picture contains only a few objects with transparency or reflections, the calculations will require little more time than with the scanline algorithm.

Since the Ray-Tracer is very complex it was designed as a standalone program. You can therefore start the Ray-Tracer without the editor, saving a lot of memory. You also have the option of controlling the Ray-Tracer by means of script files (cf. Reference VI.3.).



Picture 25

The raytracing algorithm is suitable for all applications in which you require special effects such as fog or shadows. The rendering, however, is rather complicated and can therefore take some time.

Shadows can only be rendered, of course, if you are also using light sources with the "Shadow" option enabled.

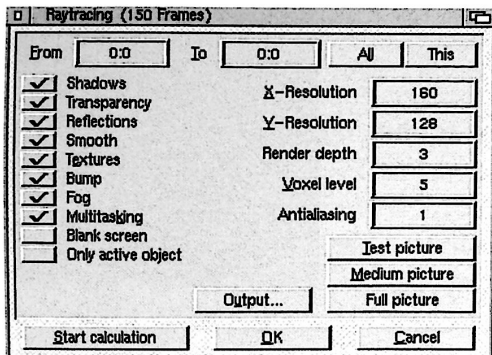
Shadow

Here you can select if the rendering is to include shadows. Shadows give a scene greater plasticity.

Processing of the picture is slowed down because the rendering of shadows requires the calculation of extra rays.

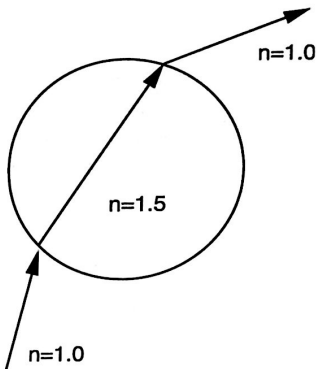
Transparency

If you are using materials which are transparent or have a transparent texture - possibly with refraction - this transparency is only shown if you have activated the “Transparency” option. The processing time for the picture is increased as the Ray-Tracer needs to calculate the transparent rays.

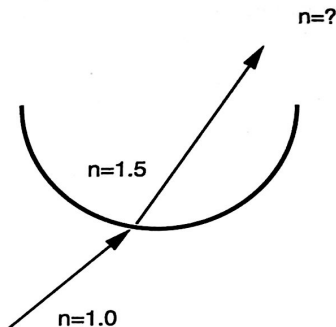


Picture 26

There can be anomalies in the picture with not completely enclosed objects such as hemispheres or a single triangle. This results from the method used by the Ray-Tracer when rendering transparency and refraction. As soon as a ray encounters a surface with transparency and refraction, the ray is weakened and deflected when passing through the surface. The ray is now located inside the object and continues until it encounters an object surface again, this time on the exit side. There it is deflected again, just as one would expect from a refracting object such as a glass ball (Picture 27).



Picture 27



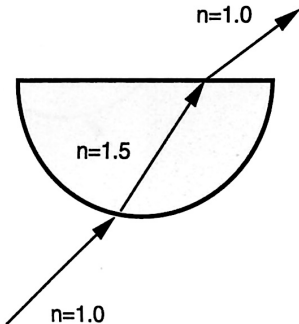
Picture 28

If, for example, you are using an open hemisphere, the ray will of course enter the hemisphere but it could happen that it never encounters a second surface (Picture 28). The Ray-Tracer will then assume that the ray is still within the hemisphere even though it is already well outside it. Do not therefore be surprised by unexpected refraction effects when using open objects and alter the objects in such a way that they are closed. You could, for example, give a second wall to an open hemisphere (Picture 29).

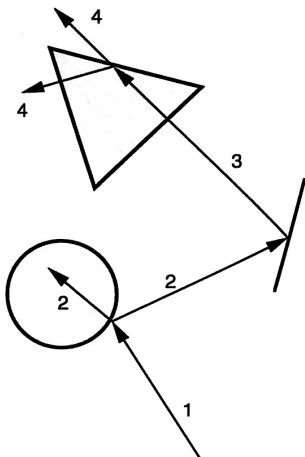
Fog

Fog objects only look like fog if this option is selected. Otherwise they will be shown as opaque. The rendering of fog, like that of transparency, requires additional processing power and increases the calculation time. This option also activates the rendering of environment fog at the same time.

Fog objects should be closed for the same reasons given for transparent objects.



Picture 29



Picture 30

Reflections

Reflecting objects are only displayed as such if this option is selected. It also slows down processing.

Rendering Depth

When the Ray-Tracer sends a ray into the scene, it will be refracted and reflected - depending on the kind of material it encounters. With certain arrangements of surfaces, for example two facing mirrors, it may happen that a ray is bounced between the two mirrors endlessly. The Ray-Tracer would never finish its calculations. To avoid this, you can use "Rendering depth" to set the maximum number of reflected or refracted rays (Picture 30).

You can also use this option to limit the processing time for the picture. In many cases, only the first reflections and refractions are of interest. Further rays make little difference to the picture but require disproportionate processing time.

A rendering depth of 1 means that processing will be stopped after a ray hits the first surface. Reflections and transparency are therefore invisible.

A rendering depth of 2 means that after the first ray hits a surface, another ray is calculated for transparency and reflection.

The greater the rendering depth, the further into the scene the rays are calculated.

This

If “This” is selected, the picture currently shown by the Perspective camera is rendered.

All

If “All” is selected, the entire animation time of the active document is rendered.

Voxel level

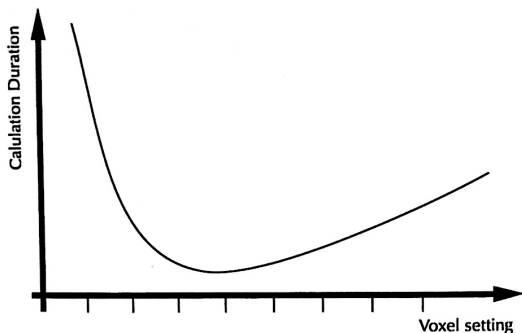
A rendering depth of 5 will normally be quite sufficient. You should only set a greater depth for scenes with many reflections & transparencies.

Here you can select the number of voxels into which the scene is to be divided. Commonly used values range from 4 to 7.

The more memory you have, the higher the values you can select, since the memory requirement is approximately a power of three of the number of voxels.

As a general rule, processing time increases with the number of voxels. At the same time, however, along with increased memory requirements, the time needed for assigning objects to the voxels increases. Picture 31 shows clearly that there is an optimal voxel level at which the total processing time is a minimum. For most scenes, this minimum equates with a voxel level of 5 to 6 so that an increase in the voxel level does not always result in an improvement.

When uncertain which value to enter, try a setting of 4. This will use relatively little memory even with fairly complex scenes. You can always experiment with a higher setting later.



Picture 31

When the Ray-Tracer runs out of memory while assigning the objects to voxels, it will abort the operation with an appropriate error message. When that happens, just repeat the rendering using a smaller voxel value or provide more memory for the Ray-Tracer.

“Smoothing”, “Textures”, “Refraction”, “Multitasking”, “Switch off picture”, “Active object only”, “X-resolution”, “Y-resolution”, “Anti-aliasing”, “Output” (cf. Reference 1.16.5).

Start Rendering

The current document is first saved under the pathname entered in the editor settings, so that it is available to the Ray-Tracer. Then Cinema4D starts the Ray-Tracer.



17. XY

This function switches to “XY view”, which is equivalent to the view from the front.

ZY

18. ZY

This function switches to “ZY view”, which is equivalent to the view from the side.

XZ

19. XZ

This function switches to “XZ view”, which is equivalent to the view from above.

3D

20. 3D

This function switches to a three-dimensional view. The objects are shown in perspective from the viewpoint of the imaginary editor camera.

4T

21. 4T

This view combines all the previously listed views, with the document window divided into four. The top left shows the 3D view, the bottom left the ZY view, the bottom right the XY view and the top right the XZ view.

P

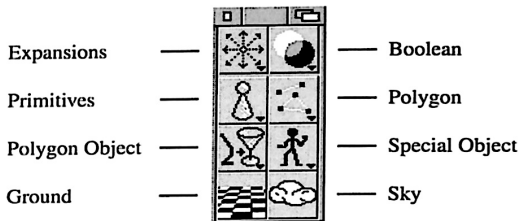
22. P

This function switches to three-dimensional view. The objects are shown in perspective from the viewpoint of the “Perspective” camera.

The editor camera is provided exclusively for the construction of objects, while the “Perspective” camera is used for the picture rendering .

II. The Object Tools Window

The object tools window contains all object-generating functions (primitives), the Cinema4D system expansions and the Boolean operations.



Picture 32

1. System Expansions



When you click on this icon with the mouse button pressed, a menu with all the installed Cinema4D system expansions opens. System expansions are separate programs capable of communicating with Cinema4D. They expand the features of Cinema4D without you having to wait for new versions of the program.

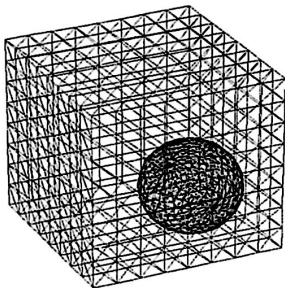
To install a system expansion, you need to place the required program into the “Expansions” drawer in the Cinema4D main directory. The next time the program is started, the system expansion will be directly available through the menu associated with the “System expansions” icon.

You can use this function even if you do not own any Cinema4D system expansions, as you can place objects constructed in Cinema4D into the “Expansions” drawer and then call them up in Cinema4D by a simple “press of a button”. This is an easy method of making frequently required object forms available as part of the program!

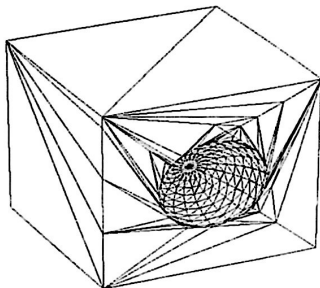
2. Boolean Operations



An interesting possibility of generating complex objects is provided by the Boolean operations of Cinema4D. These functions can be used like a woodworker's tools, to cut holes into an object, remove corners and stick on new bits.



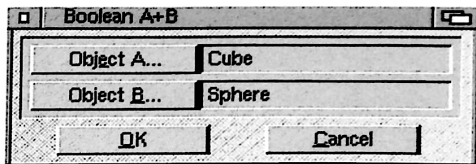
Picture 33



Picture 34

You should always use subdivided objects for the Boolean operations (Picture 33). The newly-generated object will then produce better result with the “Smoothing” function than if the original objects were not subdivided (Picture 34).

Objects generated with the Boolean functions can sometimes show hard edges even after Smoothing (“Phong shading”), as if Smoothing had been disabled. This is not a fault of the Boolean operations but an unavoidable problem: when objects with only few subdivisions are intersected, very long, thin triangles are created. These will then obstruct the “Smoothing” effect.



Picture 35

The basic precondition for the Boolean operations are two solid, overlapping bodies. If these are not closed, unforeseen results may be obtained.

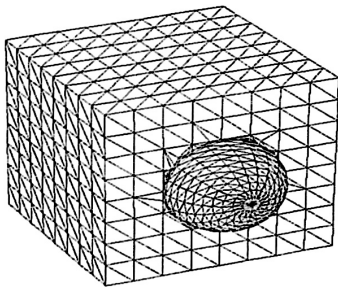
The solution lies in subdividing the objects. This makes the newly generated triangles smaller and more regular, with beneficial consequences for the picture rendering.

When calling a Boolean operation with the SHIFT key pressed, a window appears for the selection of the two objects to be linked.

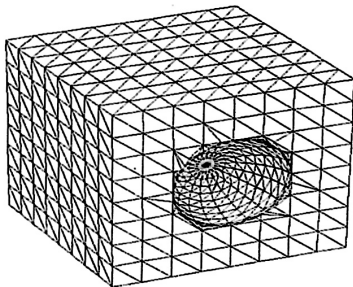
There are four different Boolean operations:

$$A + B$$

This functions adds object B to object A (Picture 36).



Picture 36: $A + B$

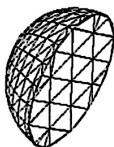


Picture 37: $A - B$

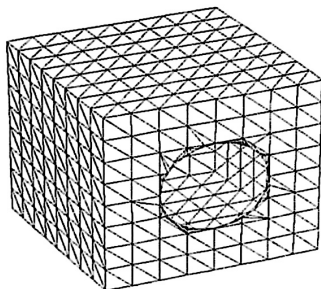
The object hierarchy is fully preserved in Boolean operations. Also, the original objects A and B are preserved. Therefore, if you only require the result obtained by the Boolean operation, you need to delete the original objects. The illustration below provides another overview of all the functions.

A - B

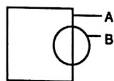
This function subtracts object B from object A (Picture 37).



Picture 38: $A * B$



Picture 39: $A - (B)$



$A * B$

This function creates the intersecting sum of object A with object B (Picture 38).



$A + B$

$A - (B)$



$A - B$

This function is similar to the “A - B” operation, but is not a true Boolean operation. It will also cut holes into the active object but not shape out the holes (Picture 39).

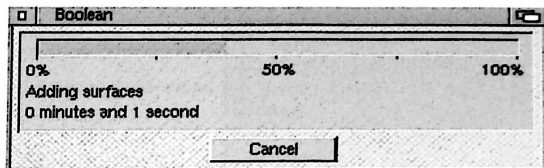


$A * B$

Since Boolean operations are very processor-intensive, the “Progress” window familiar from the picture rendering appears.



$A (-) B$



Picture 40

3. Primitives

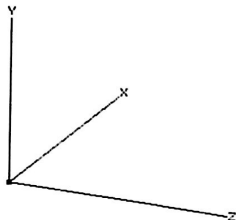


Newly created primitives will always be centred in the working area.

This icon leads to a pop-up menu with thirteen basic objects (primitives), from which you will be able to quickly assemble very complex objects. The object parameters can be changed by selecting with the right mouse button.

3.1 Axis

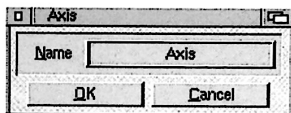
This function can be used to create an “empty” object. It is only visible on the screen by its origin or its axes (Picture 41). You can fill this object with points and surfaces later, or simply use it to group other objects.



Picture 41

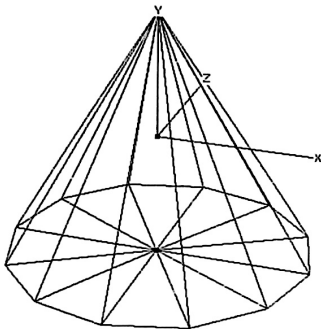
Name

Enter the name of the object here. It can consist of up to 15 characters.



Picture 42

3.2 Cone

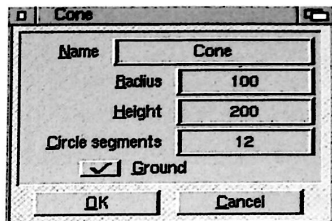


Picture 43

This function creates a cone with its bottom surface located on the XZ plane (Picture 43).

Name

Enter the name of the cone here. It can consist of up to 15 characters.



Picture 44

Radius

The radius of the circular base area of the cone at the XZ plane of the World Co-ordinate System.

Height

Height of the cone from the circular base to the top.

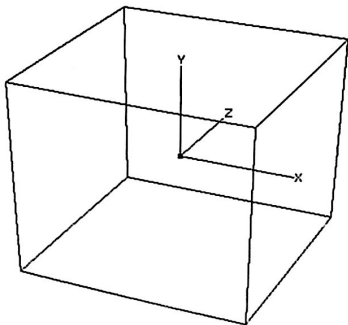
Circle Segments

Number of subdivisions. The cone surface and the base area consist of the number of segments entered here.

Base

This option is used to specify whether the cone is to have a base area or whether it is to be open at the bottom.

3.3 Cube



Picture 45

This function creates a cube, with the sides in parallel to the co-ordinate planes of the World Co-ordinate System (Picture 45).

Name

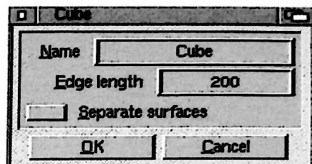
Enter the name of the cube here. It can consist of up to 15 characters.

Length of Edges

Enter the length of the edges here.

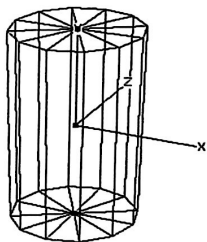
Separate Surfaces

It can be useful for some purposes to make the side faces of the cube separate objects. You can then, for instance, place a different texture on each face.



Picture 46

3.4 Cylinder



Picture 47

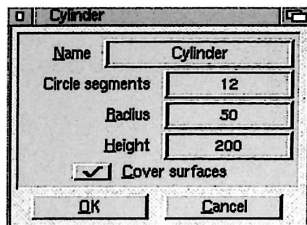
This function creates a cylinder from a number of triangles and squares (Picture 47). The cylinder axis is parallel to the Y axis of the World Co-ordinate System.

Name

Enter the name of the cylinder here. It can consist of up to 15 characters.

Radius

Enter the radius of the cylinder here.



Picture 48

Circle Segments

Enter the number of segments for the base, top, and side surfaces of the cylinder. The side surfaces are made up of squares, the base and top from triangles.

Height

Enter the height of the cylinder here.

Base and Top

Here you can choose between an open and closed cylinder.

3.5 Disc

This creates a circular disc on the XZ plane (Picture 49).

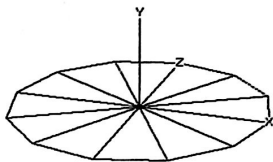
Name

Enter the name of the disc here. It can consist of up to 15 characters.

Radius

Enter the radius of the disc.

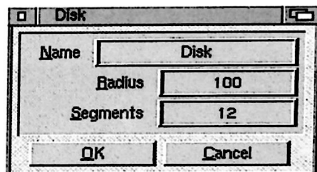
The disc is not a volume body and can therefore cause difficulties in connection with Boolean operations and refracting materials.



Picture 49

Segments

Enter the number of segments which the disc is to be made up of.



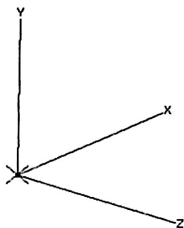
Picture 50

3.6 Light source

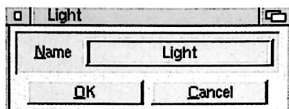
This function creates a shadow-casting standard light source, emitting white light in a straight beam at constant intensity (Picture 51).

Name

Enter the name of the light source here. It can consist of up to 15 characters.



Picture 51



Picture 52

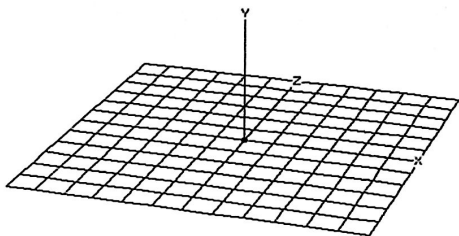
3.7 Plane

By contrast with the “Rectangle” primitive which consists of only one single area, the “Plane” function creates a rectangle which is subdivided into further rectangular areas (Picture 53). The object is located at the XZ plane of the World Co-ordinate System.

The “Plane” primitive is very well suited to subsequent modifications using the functions “Crunch”, “Wrap” or “Deform”.

Name

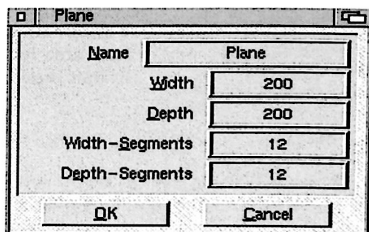
Enter the name of the plane here. It can consist of up to 15 characters.



Picture 53

Width, Depth

Here you can enter the extent of the plane in the X and Z directions.

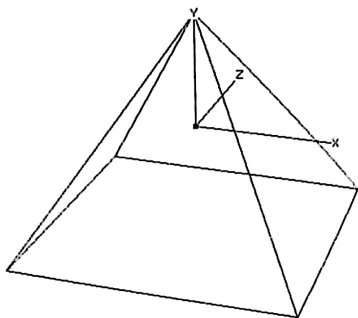


Picture 54

Width Segments, Depth Segments

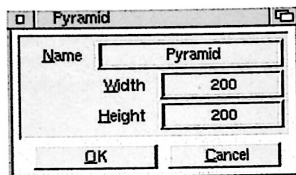
Here you can select how many rectangles the plane is made up of. If, for example, you enter 4 width and 3 depth segments, the object will be composed of 3*4 rectangles.

3.8 Pyramid



Picture 55

This function creates a pyramid with four sides, with the square base area located on the XZ plane of the World Co-ordinate System, and oriented in parallel to its axes (Picture 55).



Picture 56

Name

Enter the name of the pyramid here. It can consist of up to 15 characters.

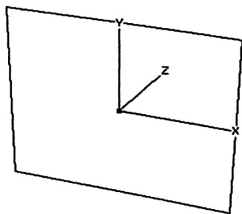
Width

This value determines the length of the sides of the square base area.

Height

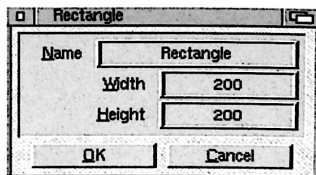
Enter the distance to the tip of the pyramid from the base area in the Y direction.

3.9 Rectangle



Picture 57

This function generates a square on the XY plane (Picture 57). The sides of the square are generated in parallel to the X and Y axes of the World Co-ordinate System.



Picture 58

The rectangle is not a volume body and can therefore cause problems in connection with Boolean operations and refracting materials.

Name

Enter the name of the square here. It can consist of up to 15 characters.

Width

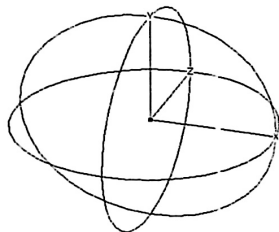
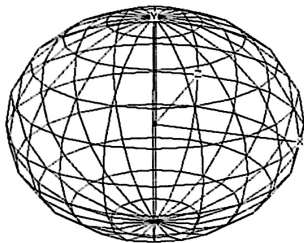
Enter the width of the square in the X direction of the World Co-ordinate System here.

Height

Enter the height of the square in the Y direction of the World Co-ordinate System here.

3.10 Sphere

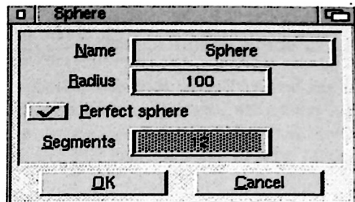
This function creates a sphere consisting of either triangles or rectangles (Picture 59), or a mathematically perfect sphere (Picture 60).



Pictures 59+60

Name

Enter the name of the sphere here. It can consist of up to 15 characters.



Picture 61

Radius

Enter the radius of the sphere.

Perfect Sphere

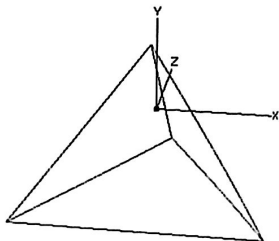
This option is used to specify if the sphere is made up of triangles and rectangles or a mathematically perfect sphere.

The perfect sphere has the advantage of looking best in picture renderings using the scanline algorithm and the Ray-Tracer, as it is actually round. It can also be rendered very quickly - much more quickly than a sphere made up of distinct faces. On the other hand, you cannot subsequently distort or otherwise modify perfect spheres.

Segments

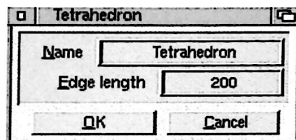
Select how many segments the sphere is to be made up of. The more segments you specify, the rounder the sphere will appear. The memory requirement and the display speed, however, are also affected by this.

3.11 Tetrahedron



Picture 62

This function creates a three-sided pyramid (Picture 62). All four sides are equilateral triangles and the edges are of equal length. One of the side faces lies on the XZ plane of the World Co-ordinate System, with one edge of the triangle in parallel with the X axis.



Picture 63

Name

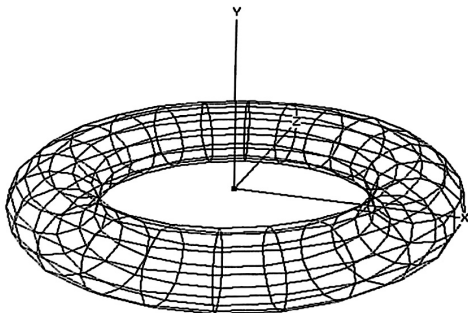
Enter the name of the tetrahedron here. It can consist of up to 15 characters.

Edge Length

Enter the length of the tetrahedron's edges here. If you want to know how far the tip of the tetrahedron is located above the XZ plane, you can calculate that using the following formula, with "k" being the length of the edges and "h" the height of the tetrahedron:

$$h = k/3 * \sqrt{6}$$

3.12 Torus



Picture 64

This function creates a torus on the XZ plane (Picture 63).

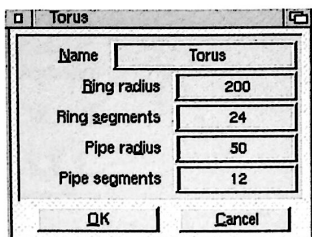
Many torus and pipe segments increase the memory requirement and slow down the display speed, but make the object more rounded.

Name

Enter the name of the torus here. It can consist of up to 15 characters.

Torus Radius

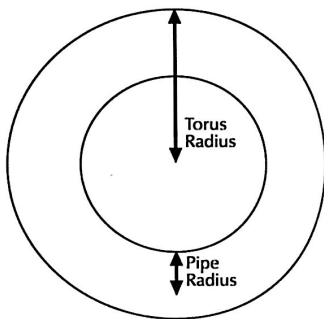
Enter the radius determining the size of the Torus (Picture 66).



Picture 65

Torus Segments

Specify how many segments the torus is to be made up of.



Picture 66

Pipe Segments

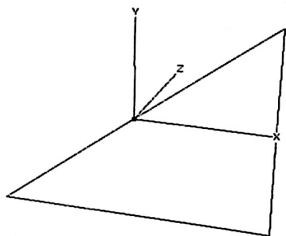
The number of subdivisions for a single torus segment.

Pipe Radius

The pipe radius determines the thickness of the pipe running through a circle with the torus radius.

3.13 Triangle

This function creates what must be the most elementary object, the triangle (Picture 67). The triangle is always created with right angles. The two small sides are parallel to the X and Y axes of the World Co-ordinate System.



Picture 67

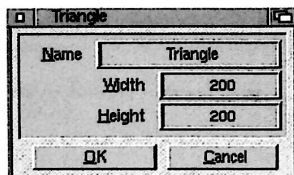
Please note that the triangle is not a volume body. It can therefore create difficulties in connection with Boolean operations and refracting materials.

Name

Enter the name of the triangle here. It can consist of up to 15 characters.

Width, Height

Here you can enter the width and height of the triangle. The triangle is created in parallel to the XY plane of the World Co-ordinate System.



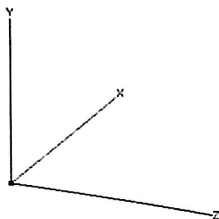
Picture 68

4. Polygons



This icon is used to call up various predefined polygons which are immediately available to create objects or animations.

4.1 Axis



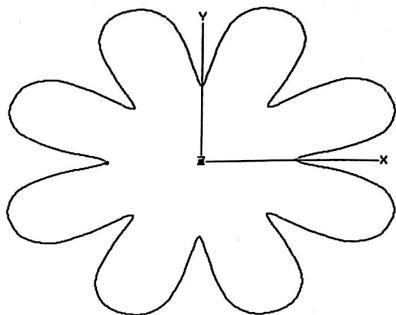
Picture 69

This function creates an “empty” polygon object. It is only visible on screen by its origin or its axis (Picture 69). You can fill this object with points and surfaces later, or simply use it for grouping other objects.

Name

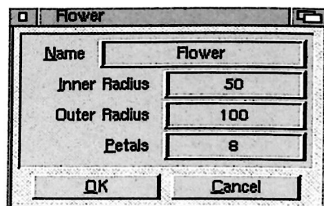
Enter the objects name. It can consist of up to 15 characters.

4.2 Flower



Picture 70

This function creates the outline of a flower with a selectable number of flower petals on the XY plane of the World Co-ordinate System (Picture 70).



Picture 71

Name

Enter the name of the polygon here. It can consist of up to 15 characters.

Inner Radius

This value defines the size of the inner radius to which the petals are attached.

Outer Radius

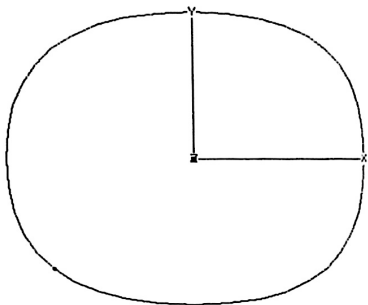
The petals stretch from the inner radius to the outer radius.

Petals

Here you specify how many petals are to be generated.

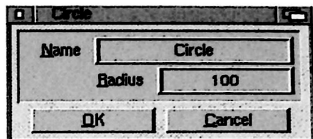
4.3 Circle

Since the circular polygon is built from only four control points and interpolated using B-spline interpolation, its outline is not precisely circular. Should the “circle” polygon not be round enough for you, you can instead use a “polygon” with several (e.g. 24) corners.



Picture 72

This function creates a circular polygon on the XY plane of the World Co-ordinate System (Picture 72). It is well suited for the generation of hoses or tubes using the “path object” function.



Picture 73

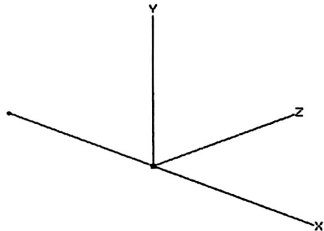
Name

Enter the name of the polygon here. It can consist of up to 15 characters.

Radius

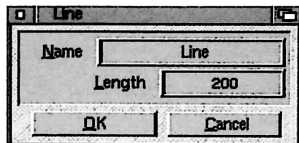
Enter the radius of the circle here.

4.4 Line



Picture 73

This function creates a line in parallel with the X axis of the World Co-ordinate System (Picture 73).



Picture 74

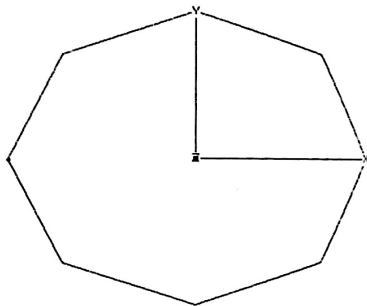
Name

Enter the name of the polygon here. It can consist of up to 15 characters.

Length

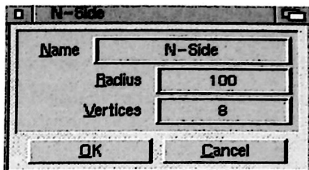
Enter the length of the line here.

4.5 N-Sided Polygon



Picture 75

This function creates a cornered, closed polygon on the XY plane of the World Co-ordinate System (Picture 75). It is well suited to the generation of hoses or tubes using the “path object” function.



Picture 76

Name

Enter the name of the polygon here. It can consist of up to 15 characters.

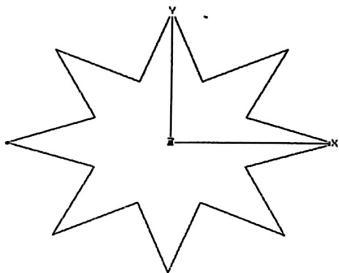
Radius

Enter the radius upon which the corners of the polygon will be located.

Vertices

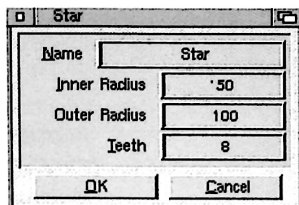
Enter the number of vertices for the polygon here.

4.6 Star



Picture 77

This function creates a closed, star-shaped polygon on the XY plane of the World Co-ordinate System (Picture 77). It is very well suited to the generation of, for example, toothed wheels using the “extruded object” function.



Picture 78

Name

Enter the name of the polygon here. It can consist of up to 15 characters.

Inner Radius

This value determines the size of the inner area to which the “teeth” are attached.

Outer Radius

The “teeth” stretch from the inner radius to the outer radius.

Teeth

Enter the number of “teeth” to be generated here.

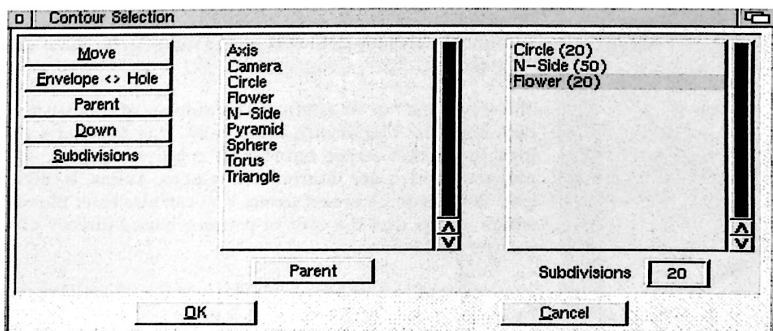
5. Polygon objects



Here you can find the most sophisticated functions for creating objects. You can wind one polygon around another, e.g. to obtain a hose, or combine several closed polygons (layers) into one object, with these being automatically linked by triangles and squares. Half a dozen cross sections of a human head - perhaps generated by a computer tomograph - will instantly produce a realistic “head” object. The simple contour of a letter can be quickly turned into a three-dimensional letter with rounded edges. Another unique feature is the ability to specify shapes with holes in them.

You need to enter one or more contours for all polygon objects, this is why polygon objects have the “Select contour” field. This field opens the same contour selection window (Picture 79).

Each polygon object also offers the possibility of creating end plates. The parameters are set by clicking on the “Ends” field.



Picture 79

Select Contour Window

A window appears with two lists. The list on the left displays all available polygons. If you select one of these polygons and click on “Move”, the name of the polygon will appear in the list on the right. This list indicates the selected polygons. Instead of using “Move”, you can also double-click on the name of a polygon in the list on the left - provided the polygon does not contain any sub-objects. If that is the case, the left list will show the contents of the polygon.

If you want to specify a hole polygon for a contour (the letter B, for example, requires two hole polygons) then you need to transfer it to the right first. Select it in the right-hand list and, using “Higher” or “Down”, place it immediately beneath the contour. Then click on “Envelope<>Hole”. The name of the polygon in the right-hand list will be indented and marked with the “Hole” icon to indicate that it is an envelope polygons.

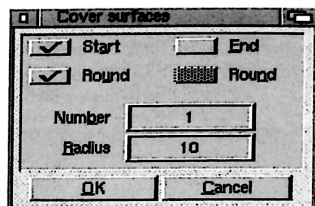
You can add further hole polygons using this method.

Unwanted polygons in the list on the right can be removed with “Move”.

“Subdivisions” is for entering the number of subdivisions for each contour. The default value is 20. It is sometimes a good idea to enter a larger number of subdivisions (e.g. 40) for polygons which are interpolated (Cubic, Akima, B-spline) to give the polygon a round shape. You can also enter the value 0 which means that the control points are used directly without interpolated points.

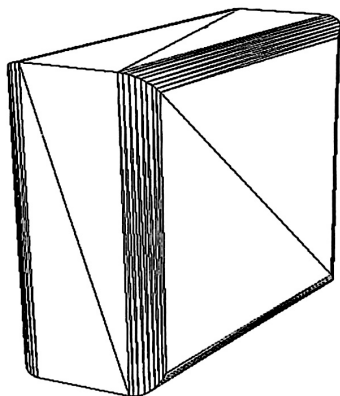
You can set the number of subdivisions for all contours at once by clicking on “Subdivisions”.

Ends Window



Picture 80

Here you can selectively specify, using “Start” and “End”, if the start or end contour is to be closed. Cinema4D will automatically take into account any hole polygons and form the covering end plates accordingly.



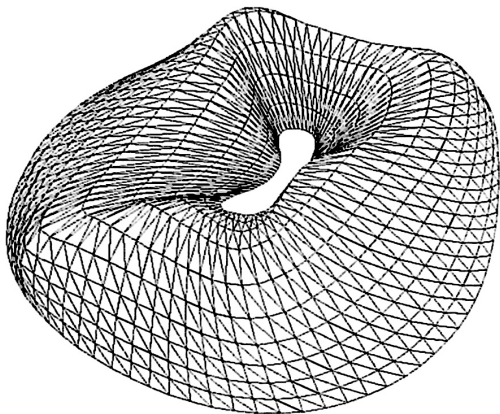
Picture 81

Please note that the algorithm used in rendering the closing faces is very complex and can take some time when several hole polygons are used.

A useful feature of Cinema4D is the ability to not only place the end plates on the start and end contours but to round the edges (Picture 81). If you have activated the “Round” option, Cinema4D will move the edges of the end plates in a user-definable “Number” of steps in such a way that the edges, seen in cross section, form a quarter circle with a selectable “Radius”. You can therefore create professional 3D fonts.

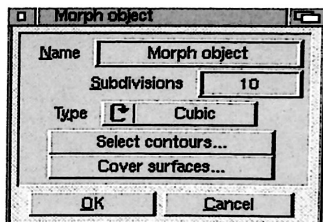
Please note, however, that the algorithm cannot perform miracles. Since the edges are always moved in parallel to the original edge, the edges may end up outside the object if you enter too large a radius. You must ensure that the radius values are within a reasonable range, or Cinema4D will be unable to create the end plates.

5.1 Morph Object



Picture 82

This extremely powerful function provides a relatively quick and uncomplicated method of creating organic shapes (Picture 82). You can specify several contours to do this. Cinema4D links the contours, one after the other, with a freely selectable number of points. In addition, you can specify if two contours are to be linked directly or through a selectable interpolation type. You can, for example, construct a cornered bottle ending at the top in a round bottle-neck leaning downwards.



Picture 83

Name

Enter the name of the morph object here. It can consist of up to 15 characters.

Subdivisions

Enter the number of steps in which the transition from the first to the last contour is to occur.

Type

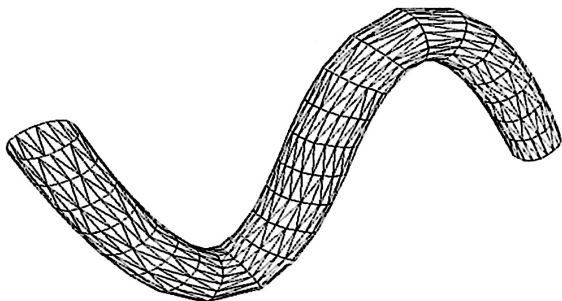
Here you select the spatial curve on which the interpolated intermediate contours are to be located. As with polygons, you can choose between “Linear”, “Akima”, “B-Spline” and “Cubic”. With linear interpolation, the intermediate contours will be on a direct path between the specified contours, otherwise the transition will be softer and dependent on the following contours.

Select Contours, Ends

Here you select the contours and set the parameters for the end plates. You must select at least three contours. If you select the contours in the wrong order by mistake, you can correct this using the “Higher” and “Down” fields.

All contours must have the same number of subdivisions. If you change one value, Cinema4D will automatically copy this to the other contours.

5.2 Path object



Picture 84

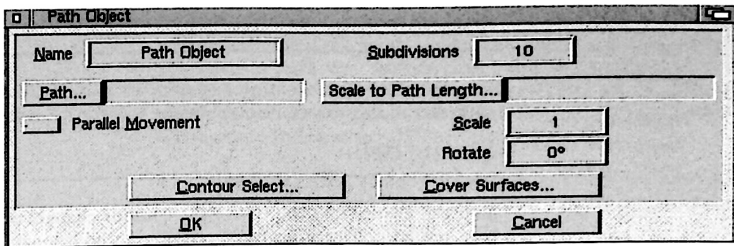
This function is used to arrange a contour along a path in order to create an object (Picture 84).

Name

Enter the name of the path object here. It can consist of up to 15 characters.

Path

Select the polygon to be used as the path for the contour.



Picture 85

Subdivisions

Enter the number of steps in which the contour is moved along the path. The more subdivisions you select, the smoother the path object will appear.

Parallel

Select this option if you do not want the contour to follow the curve of the path but remain parallel to its original position. The contour will not be positioned at the beginning of the path but retain its position.

Scaling

You can make the contour shrink or grow during its movement along the path in a linear fashion. A scaling factor of 3.0, for example, will make the contour grow to three times its original size, while a factor of 0.5 halves it.

Scaling is always linear. If you want non-linear scaling, you need to use the “scaling path”.

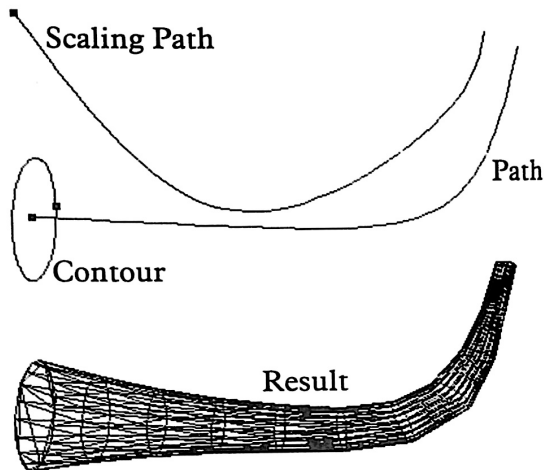
You do not need a scaling polygon for simple linear scaling. It is sufficient to enter the required value under "Scaling".

Rotation

You can also rotate the contour during its movement along the path. Rotation always take place by the polygon's Z axis.

Scaling path

You can ensure that the size of the contour changes according to a predefined manner by specifying an additional "scaling path". Cinema4D will then always calculate the current distance between the path polygon and the scaling polygon when creating the path object. If the distance is greater than the starting distance between the two polygons, the contour is enlarged, otherwise it is shrunk (Picture 85).



Picture 85

As soon as you enter a scaling polygon, the input field for linear scaling is disabled. To be able to enter a numerical value again, you need to click on “scaling path” and not have an object selected in the object selection window. You can do this by clicking in the empty space underneath the selection list before leaving the window with “OK”.

The Cinema4D arrangement algorithm is fairly difficult to understand. If you don't need to know how exactly the program works you can skip this section.

To begin with, Cinema4D positions the contour in accordance relative to the beginning of the path:

- The Z axis of the contour is rotated so that it becomes tangential in relation to the path.
- The X axis of the contour is rotated so that is located on a plane parallel to the XY plane of the path Object Coordinates System. If, for example, you arrange a contour alongside the predefined “Circle” polygon, the contour's X axis will be on the plane defined by the circle.
- The contour's Y axis will be positioned so that it points in the direction opposite to that of the path's Z axis. If, for example, you create a letter with an asymmetrical contour, you need to rotate the contour axes by 180 degrees to make the contour “flip” inside out.

All subsequent arrangements are based on the previous contour. The contour will be rotated so that its Z axis is once again tangential to the path. This rotation is clearly defined.

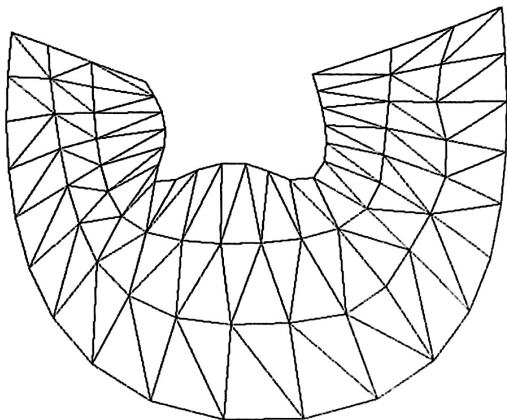
This algorithm ensures that good and predicable results are achieved even with the most complex three-dimensional path polygons.

Select Contour, Ends

cf. Reference II.5.1

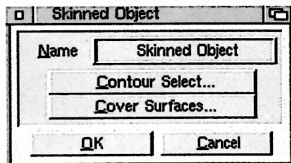
Cinema4D
always starts
linking two
contours at their
beginning.
Therefore you need
to ensure that the
beginnings of the
polygons are
located roughly at
the same position,
otherwise the
skinned object will
appear distorted.

5.3 Skinned Object



Picture 86

The skinned object occupies a special position among the polygon objects as you can control the appearance of an object very precisely, skin by skin (Picture 86). If, for example, you have entered several polygons (e.g. using pictures from a computer tomograph), you can have these linked with each other in order to obtain a three-dimensional object.



Picture 87

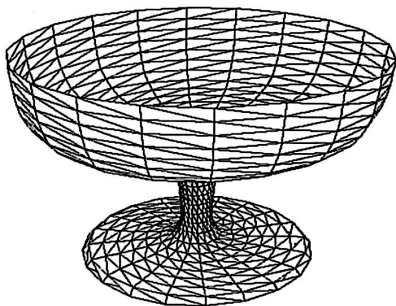
Name

Enter the name of the skinned object here. It can consist of up to 15 characters.

Select Contours, Ends

cf. Reference 11.5.1.

5.4 Lathed Object

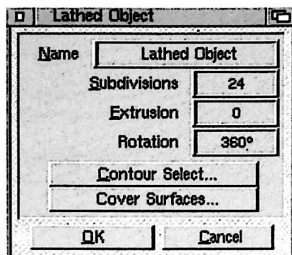


Picture 88

The lathed object is very similar to the extruded object. Instead of extruding a contour, you can make the contour rotate around its Y axis (Picture 88). If you add a simultaneous extrusion, the contour will be wound around the rotation axis as if threaded down a screw (Picture 90), and you can use this as a simple method of generating screws and lathes.

Name

Enter the name of the lathed object here. It can consist of up to 15 characters.



Picture 89

Subdivisions

Enter the number of steps for the rotation here. The more subdivisions you enter, the more rounded the lathed object will appear. With a rotation of 360 degrees you should enter 8 or more subdivisions.

Extrusion

Here you specify how far the contour is to be extruded in the direction of the rotation axis (the contour's Y axis) while being rotated. If you enter a value of 0, the contour will only move around in a circle.

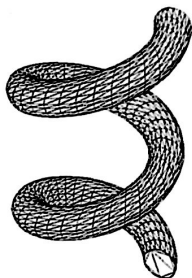
Rotation

Enter here the rotation angle for the contour. An angle of 720 degrees, for example, means two full rotations.

Select Contour, Ends

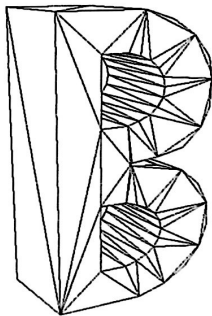
cf. Reference II.5.1.

The arrangement of the contour along the lathe path follows the rules described for the "path object" function (cf. Reference II.5.2.)



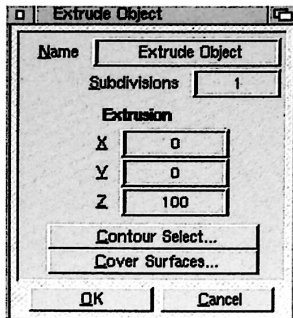
Picture 90

5.5 Extruded object



Picture 91

This function allows you to extrude a polygon in a user-definable direction (Picture 91). Cinema4D will automatically link the original polygon and the extruded polygon with squares. The end plates can be closed so that the object is closed, if desired.



Picture 92

Name

Enter the name of the extruded object here. It can consist of up to 15 characters.

Subdivisions

Enter here the number of steps for the extrusion. A subdivision of 1 means that the start and end contours are linked directly. If you intend a subsequent alteration of the object, you should enter a higher subdivisions value here. Cinema4D will then insert additional contours between the start and end contours.

Extrusion

Here you enter the direction in which the contour is to be extruded. If, for example, you have created a letter outline on the XY plane of the World Co-ordinate System, you can extrude this into depth with a value of (0,0,100).

Select Contour, Ends

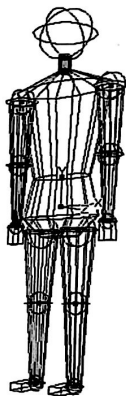
cf. Reference II.5.1.

6. Special objects



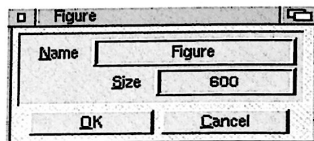
This icon covers a collection of highly complex objects which you can generate by the push of a button.

6.1 Figure



Picture 93

This function calls up an “animation-ready” figure (Picture 93). Since all the hierarchies are already present, you can place the figure into the desired position very easily using the “Drag” function.



Picture 94

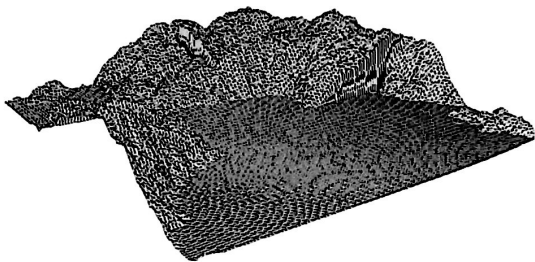
Name

Enter the name of the figure here. It can consist of up to 15 characters.

Size

Enter the Y extent of the figure here. The other extents are adapted to this proportionately.

6.2 Fractal



Picture 95

This function can create craggy mountains or rolling hills at the push of a button. Just click with the mouse to have the mountains appear on screen.

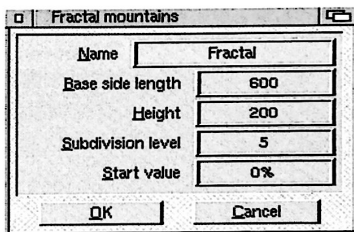
The “Fractal” function generates an irregularly shaped object following the fractals principle (Picture 95).

To begin with, a simple square is created on the XZ plane of the World Co-ordinate System. Cinema4D then subdivides this square into four smaller squares and moves the points at which the larger square was subdivided by a value of “w” along the Y axis upwards or downwards at random.

Then each of the four small squares is subdivided into four even smaller squares, so that there are 16 squares in all. Again, their division points are randomly moved upwards or downwards, but this time only by a maximum of half the value of “w”. The whole procedure is repeated until the required level of subdivisions has been reached, thus transforming a coarse structure of a few squares into complex mountain ranges with many details.

However, since the squares generated are no longer level, Cinema4D will finally divide each into two triangles.

If Cinema4D did not half the maximum value for the random move after each subdividing step, you would simply obtain a shape resembling a steel brush or a hedgehog rather than a mountain. The basic principle of fractal structures is to add small random changes to data, with these changes themselves being dependent on the data. Without this dependence, the data would just be arbitrary and chaotic.



Picture 96

Name

Enter the name of the fractal here. It can consist of up to 15 characters.

Base Side Length

Here you enter the edge length for the fractal, which has a square outline on the XZ plane.

Height

This value determines the height of the fractal.

The fractal is formed in such a way that the mountain unfolds in the direction of the positive Y axis. Values below the XZ plane (the Ground) are ignored.

Subdivision Level

This numerical value determines how often the subdivision takes place. Starting with a single square, a subdivision level of n generates a number of 2^n squares. Since all squares are finally subdivided into triangles, twice as many triangles are obtained.

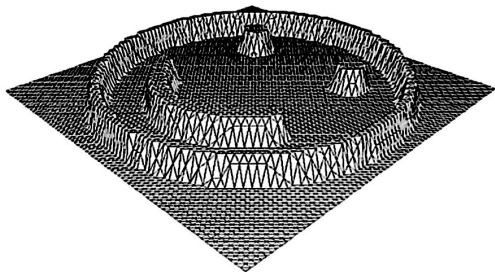
Do not enter excessively high values here, as each level doubles the amount of memory required.

Start Value

If a totally random function were used for the random movement of the subdivision points, you would get a different mountain every time you call up the “Fractal” function.

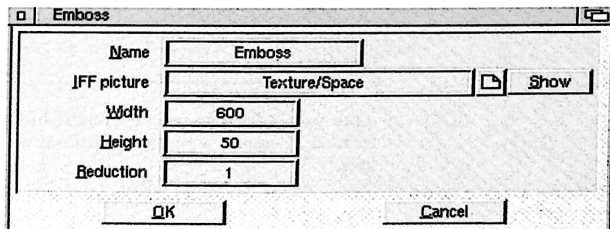
For this reason, Cinema4D uses a quasi-random function that can be controlled with a numerical value. Identical values will generate identical mountains every time. The value is freely selectable between 0% and 100%.

6.3 Emboss



Picture 97

This function interprets the grey values in a picture as height values and transforms them into a three-dimensional relief. The relief is created on the XZ plane of the World Co-ordinate System (Picture 97).



Picture 98

The average value of the red, green and blue values of a pixel is interpreted as height. Black equals the minimal height, and white the maximum.

Name

Enter the name of the displacement object here. It can consist of up to 15 characters.

IFF Picture

Enter the pathname of the picture from which the relief is to be generated.

To check that the right picture is selected or that the pathname is correct, you can click on "Show". Cinema4D will load the picture into memory and display it on the screen. The display is stopped with a mouse click, and the width, height and colour depth of the picture are shown in a window.

Width

Here you can enter the edge length of the displacement object, which has a square outline on the XZ plane. While the width is set using "Width", the depth of the relief is a result of the combination of "Width" and the format of the picture. If, for example, you have entered a width of 600 units and the picture's dimensions are 300*200 pixels, the relief will be 400 units deep.

Height

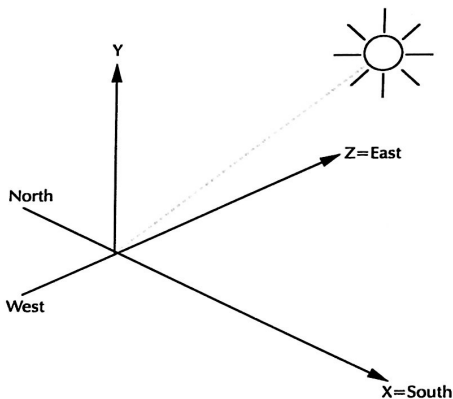
This value determines the height of the relief. The relief is formed in such a way that it unfolds in the direction of the Y axis.

Reduction

This factor specifies if really every single colour pixel is to be used. Two triangles are generated for each pixel, and with a “small” picture of 320*256 pixels resolution that will amount to no less than 163840 triangles, which is more than Cinema4D will allow. Objects can only contain up to 65520 triangles. Whenever Cinema4D realises that this limit is exceeded, it will automatically reduce the picture to a lower resolution. Here you can select explicitly whether such a reduction is to be carried out every time, i.e. even when the limit is not exceeded.

If, for example, you change the reduction value to 3, 3*3 pixels will be taken together and converted into a height value. The greater the value for “Reduction”, the lower the number of triangles generated. At the same time, however, height details are lost.

6.4 Sun



Picture 99

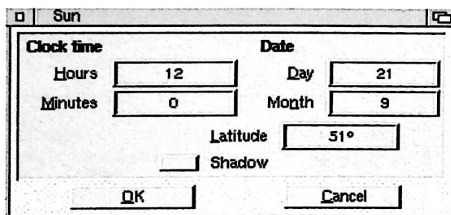
A feature of particular interest to architects is this function which creates a light source simulating the sun. You only need to enter a date and your scene will be lit by a light source with the correct position and even the correct colour for the sun. The values to be entered are the date, the time (CET) and the geographical location.

The X axis of the World Co-ordinate System is taken as South, and that is where the sun will be located at 12 noon. East (sunrise) is therefore located in the direction of the Z axis, West in the direction of the negative Z axis and North in the direction of the negative X axis (Picture 99). Since Cinema4D cannot generate light sources at an infinite distance, the light source will simply be placed at a very great distance from the origin of the World Co-ordinate System. In addition, the light source has parallel beams.

The sun is only generated if it is above the horizon (Day).

The colour of the sun is not pure white but corresponds to the yellowish light as changed by the absorption spectrum of the atmosphere, shifted into the red spectrum as the sun approaches the horizon.

The “Sun” function is intended for users who need to simulate realistic colours and shadows at different times of day, for example in landscaping or house construction.



Picture 100

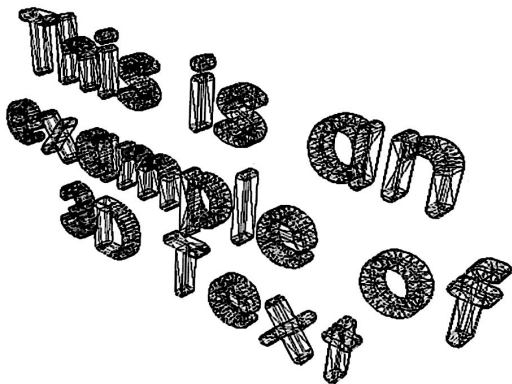
Time, Date

Enter the time (CET) and the date for which the position of the sun is to be calculated. Summer time is ignored, so for the summer months you need to subtract an hour from the Central European Summer Time in order to obtain the Central European Time.

Geographical Position

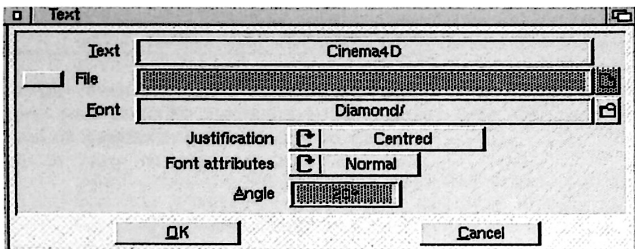
Here you enter the latitude of your location on the globe. For Munich this is approximately 48 degrees, for Frankfurt 50.1 and for Hamburg 53.6.

6.5 Text



Picture 101

This function is ideal for video titling as it gives an easy method of creating three-dimensional text. All you need to do is to enter text or load an ASCII file, and you will obtain an object consisting of three-dimensional characters (Picture 101).



Picture 102

Text, File

Here you enter the text which Cinema4D is to generate. To use an ASCII file for this purpose, select the option “File” option and enter the filename.

Font

Here you select the font to be used. Cinema4D is supplied with two fonts but you can also use any of the large number of free public domain fonts or create your own (see below). The many polygons supplied can be used as a starting point for the creation of your own three-dimensional characters.

Justification

If you are using multi-line ASCII files, you can select how the three-dimensional text will be justified. The choice is between flush left, flush right and centred.

Attributes

You can select “Normal” or “Italic”.

Angle

If you have selected the italic attribute, Cinema4D will tilt the characters by the angle entered here. The larger the angle, the more the characters “lean over”.

If you wish to create your own fonts you need to follow these rules:

- Ensure that your letters are parallel to the World Co-ordinate System. The letter “H”, for example, should be oriented in such a way that the horizontal line is parallel to the X axis and the two vertical lines parallel to the Y axis of the World Co-ordinate System. Position the letters so that their base line is on the X axis of the World Co-ordinate System.
- Create a drawer for the font on the hard disk, under the font’s name.
- Save the three-dimensional letters individually to this drawer. Their filenames should be their corresponding ASCII numbers, so that the letter “a”, for example, is saved as “87” and the “A” as “65”.
- Cinema4D will always place the characters in sequence. Due to the fact that they are of different sizes - the object “I” is narrower than the object “W” - a proportional font is normally generated, unless you ensure that all characters have identical dimensions in the X direction.
- Cinema4D must be told about the spaces between characters and between lines. For this reason, you need to create an additional ASCII file called “Description” in the character set’s drawer with the distances between characters and lines. You also need to indicate the width of the space character.

The character spacing is the gap between two characters, while the line spacing is the gap between the base lines of two lines of text.

This file must have the following structure:

Character spacing <value>

Line spacing <value>

Space <value>

It is probably best to copy one of the description files supplied and just change the values.

It is up to you, of course, what you save under a particular ASCII number. You could, for instance, define a character set consisting of chess pieces.

7 Ground



The Ground is a special object which can only be present once. It is always - irrespective of its object axes - located on the XZ plane and passes through the origin of the World Co-ordinate System. You can, however, freely assign materials and textures to it.

The Ground can be enabled or disabled by selecting this icon. If the Ground is enabled, its menu entry will be marked with a tick. In the object window, the "Ground" icon will be depressed.

The Ground is only displayed in rendered pictures. It appears in the workspace only if activated as an object.

8 Sky



The Sky is an infinitely large sphere with its centre in the origin of the World Co-ordinate System. The Sky is a special object much like the Ground, in that only one Sky can exist in a scene.

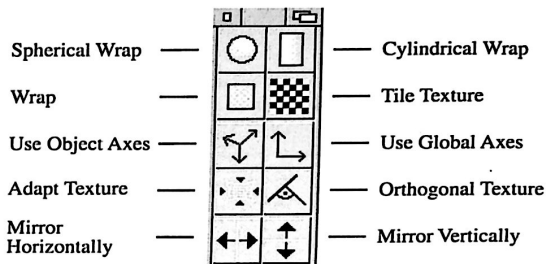
You can enable or disable the Sky by selecting this icon.

The Sky is only displayed in rendered pictures. It only appears in the workspace if activated as an object.

To facilitate editing the Sky texture, a fixed spherical surface is displayed on which you can freely move the texture. This spherical surface represents the infinite Sky sphere which cannot be displayed in this form. You have to make do with a sphere of finite size. Do not be confused by other objects apparently being located outside of this spherical surface.

III. The Texture Tools Window

The texture tools window provides the most important functions for editing textures.



Picture 103

1. Wrap Spherical



When you click on the “Wrap sphere” icon, the texture is projected onto the object radially, i.e. in spherical form (cf. Basic 16.).

2. Wrap Cylinder



When you click on the “Wrap cylinder” icon, the texture is projected onto the object in cylindrical form (cf. Basics 16.).

3. Wrap Object



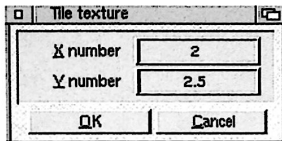
When you click on the “Wrap object” icon, the texture is projected onto the object flatly (cf. Basic 16.).

4. Wrap Tile



Here you can enable or disable the “tiled texture” using the left mouse button (cf. Basics 16.).

When you click on the “Wrap tile” icon using the right mouse button, a window appears in which you can specify how often the texture is to be projected into the active object.



Picture 104

You can see the numerical values “X number” and “Y number” in this window. Cinema4D calculates these from the current size of the texture. If, for example, you have scaled the texture so that it has a size of 25% in the X direction and 50% in the Y direction, Cinema4D calculates that the texture will fit onto the surface 4 times ($1.0/0.25$) in the X direction and 2 times ($1.0/0.5$) in the Y direction.

If you now change the “X number” or “Y number”, the size of the texture will change automatically. If, for example, you increase the “Y number” to 3, the texture will shrink from 50% to 33.33%. You can view this instantly by leaving the window with “OK”.

5. Use Object Axis



This function rotates the texture axes in such a way that they are parallel to the object axes.

6. Use World Axis

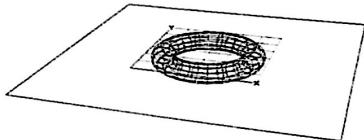
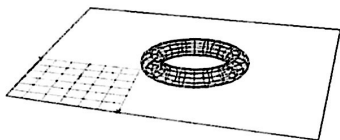


This function rotates the texture axes in such a way that they are parallel to the axes of the World Co-ordinate System.

7. Adapt Texture to Object



Clicking on this icon changes the position of the texture axes and the texture so that the texture fully covers the active object (before: Picture 105, After: Picture 106). After calling this function, the texture has a size of 100% in both the X and Y directions.



Pictures 105 + 106

8. Orthogonal Texture



This function moves the texture so that it is orthogonal (vertical) in relation to the viewpoint. In the “Perspective” and “3D” views, this is the camera plane, in all other views the workspace.

9. Mirror Horizontally



This function is used to mirror the texture horizontally before being projected.

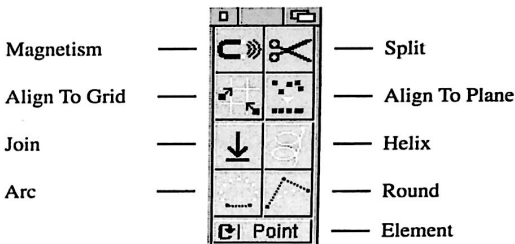
10. Mirror Vertically



This function is used to turn the texture upside down before being projected.

IV. The Point Tools Window

This window offers extensive possibilities of editing and reshaping objects. Individual points, edges, faces as well as entire groups can be edited.



Picture 107

The first four functions of the point tools window can be applied to points of bodies as well as points of polygons. The next four icons will only work with polygons. The “Elements” icon, however, will only work with bodies.

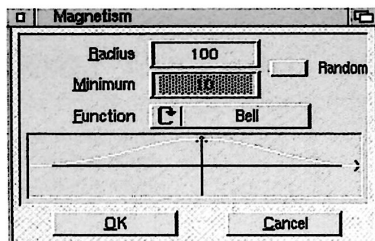
1. Magnet



A very useful feature for the creation of freeform shapes is Cinema4D's ability to draw points out of the object by using a magnet.

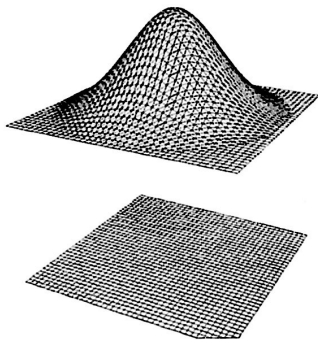
Select “Move” and grab a point in the active object. The surrounding points follow the mouse pointer at a certain distance - which is greater, the further the point is moved by the mouse (Picture 108).

You can enable or disable the magnet with a left mouse click on the “Magnet” icon.



Picture 108

If you select the icon with the right mouse button, the “Magnet” window appears:



Picture 109

Radius

Here you set the range of the magnet effect. Each point of an object which is no further away from the selected point than the distance entered here, will be affected.

Random

The magnet's radius is randomised by the program if you select this option. The radius will then oscillate between the values entered for "Radius" and "Minimal radius".

One application of this function is to generate hilly landscapes. Hills of different sizes can then be created without the need to reset the "Radius" every time.

Function

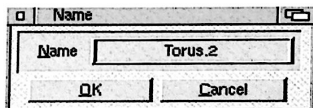
Here you select the function to be used in order to calculate the reduction in the strength of the magnet in relation to the distance. The function is displayed graphically in the "Magnet" window. The following functions are available Bell, Circle, Needle, Wave 1, Wave 2, Constant, Linear, and Parabolic.

2. Split



This function creates a new object from the selected points, edges or faces. The active object remains unaffected.

If you have selected points, all points and all edges and faces attached to the points will be transferred to the new object. Equally, if you have selected edges, all attached points and faces are used. The function always uses all selected elements and all other parts completely attached to them.



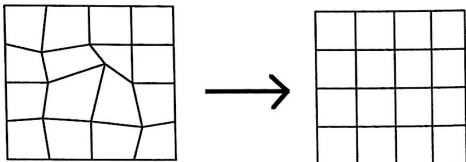
Picture 110

This function is very handy for dissecting existing objects into their constituent parts, as Cinema4D can only assign textures and materials to objects.

3. Align to Grid



It is often useful to place points precisely onto the grid. If, for example, you forgot to activate the grid at the start, you can now correct this. Clicking on the “Align to grid” icon will align all points with the grid, even if the grid is not active. (Picture 110).



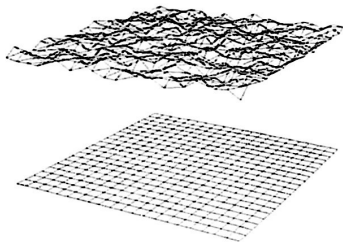
Picture 110

4. Align to Plane



This moves all active points into the same plane (Picture 111).

In “XY” view this is the XY plane, in “XZ” view it is the XZ plane and so on. In the “3D” and “Perspective” views, the active points are moved to a plane which is parallel to the camera plane.



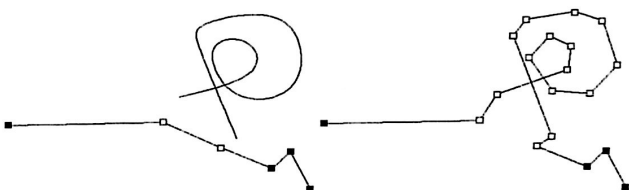
Picture 111

5. Join (only for polygons)



Select this function in order to insert an existing polygon between two control points of the currently edited polygon. The object selection window will appear for you to select the polygon which Cinema4D is to insert.

With two adjacent points in the currently edited polygon active (Picture 112), the polygon will be inserted between these two points (Picture 113). Otherwise the new points are appended at the start of the polygon.



Pictures 112 + 113

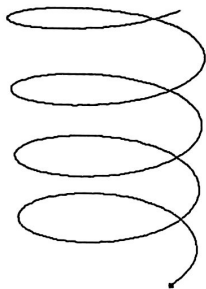
6. Helix (only for polygons)



This function is used to insert a helix with a certain number of control points at any part of a polygon. With two adjacent points active, the helix will be inserted between these two points (Picture 114).

The helix always spins around the Y axis of the World Coordinate System.

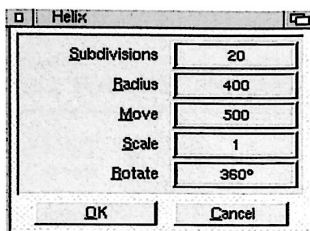
When you click on the “Helix” icon with the right mouse button, a window appears for you to control the appearance of the helix.



Picture 114

Subdivisions

Enter the number of control points of which the helix is to be made up.



Picture 115

When using the linear interpolation for the polygon, you should not specify too few control points as the helix will turn out too coarse. A good value is 36 subdivisions for a rotation of 360 degrees.

However, with one of the softer interpolation types you will only need a few control points.

Radius

Enter here the radius of the helix.

Length

Enter the length of the helix along the Y axis. A length of 0 will generate a circle (or arc) rather than a helix.

Scaling

This value determines if the helix will be reduced (<1.0) or enlarged (>1.0) while moving along the Y axis.

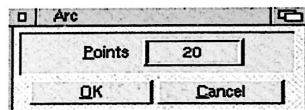
Rotation

Enter the number of rotations around the Y axis. An angle of 360 degrees, for example, is equal to one single rotation.

7. Arc (only for polygons)

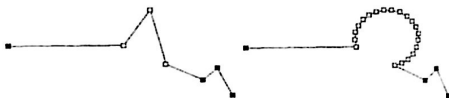


This function is used to insert an arc with a certain number of control points anywhere in a polygon. To do this, you activate three adjacent control points (Picture 117). Cinema4D assumes that these three points are located at the edge of the circle and calculates the radius of the arc from their positions. As you can see in Picture 118, the arc starts at the first and ends at the third of the three active points.



Picture 116

When you click on the “Arc” icon with the right mouse button, a window appears for you to specify the number of control points for the arc.



Pictures 117 + 118

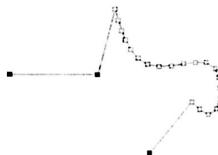
8. Round (only for polygons)



This function is used to round any part of a polygon. Start by activating only the points of the polygon which you want rounded (Picture 119). These points must be adjacent to each other.

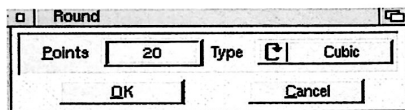


Picture 120



Picture 120

Then click on the “Round” icon. The active points are replaced by a larger number of points, giving a smoother curvature (Picture 120).



Picture 121

When you click on the “Round” icon with the right mouse button, a window appears for you to specify the number of points and the type of rounding.

Points

Enter the number of points to be used for rounding the curve. You must enter a larger number than the currently active points.

Type

Here you select the type of rounding. You can choose between the interpolation types Linear, Cubic, Akima and B-Spline.

9. Elements

 Point

 Face

 Edge

This icon is used to select whether you wish to edit points, edges or faces. The setting only applies to the editing of bodies. With polygons, only the points can be edited.

Depending on the selection made, mouse input will be interpreted differently (cf. Basics 12.).

V. The Menu Functions

This, the most extensive part of the manual, contains all the menu functions. They are listed in sequence.

1. Project

The “Project” menu contains all the functions relating to documents or the program itself.

1.1 New

Opens a new document and the new document becomes active. All functions in the icon bars and menus will now relate to the new document.

A newly opened document is positioned with a slight offset in relation to existing documents.

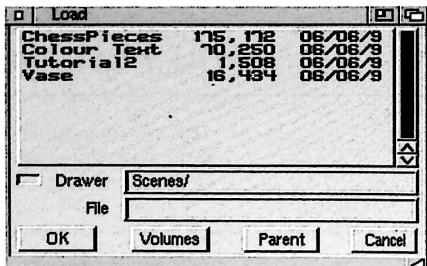
While the new document has not been saved under a new name, the name “Untitled” appears in the top line of the document window.

1.2 Open

Loads an existing scene from the hard disk into memory and opens a new document window.

However, if the active document window is empty and unchanged (e.g. immediately after starting the program), no new document window is opened and instead the existing one is used.

A newly opened document is positioned with a slight offset in relation to existing documents.



Picture 122

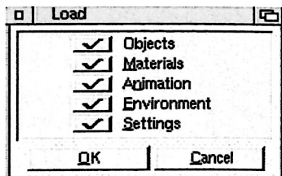
After selection “Open”, the file requester window appears for you to enter the name of the scene to be loaded.

If you selected “Open” with the SHIFT key pressed, a further window appears for you to select which parts of the file are to be loaded. This window is explained in the next section.

1.3 Insert

This function is used to insert existing scenes, objects, materials etc. from the hard disk into the active document.

First the file requester window appears for you to select the pathname for the file.



Picture 123

Then the “Load” window appears, in which you can specify precisely which parts of the file are to be inserted.

- The “Objects” option indicates if objects are to be inserted. Sky, Ground and “Perspective” camera are special objects and remain unaffected by this.
- The “Materials” option is used to enable or disable the insertion of materials. Materials can be loaded independently of the objects. Objects loaded without materials are assigned the white standard material.
- The “Animation” option is to control the animation data of objects, camera, Ground, Sky and environment.
- The “Environment” option indicates if the scene environment is to be loaded. Caution: this can overwrite parts of the settings for the active document. Since, for example, Cinema4D only allows a single Ground object, the inserted Ground object will overwrite the old one. By environment, Cinema4D means Ground, Sky, “Perspective” camera and the settings for the “Environment” function.
- The “Settings” option indicates if any settings present in the file are to be loaded into memory. Caution: any existing settings will be overwritten. By settings, Cinema4D means the values entered in the rendering windows (e.g. screen mode, resolution, picture numbers...) and the settings for the editor camera and the visible document area.

1.4 Close

Closes the currently active document. If the document has been changed, a safety alert will appear first.

The “Safety alert” setting in the “Editor” window does not affect this. Safety alerts will always appear when a document is closed or the program exited, unless no changes appear to have been made.

1.5 Save

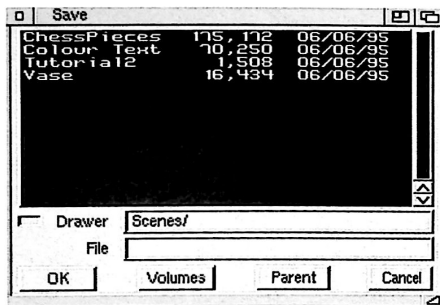
This function immediately saves your document to the disk or hard disk, without first opening the file requester window. The scene is saved under the name entered with “Save as”, which is always displayed in the top line of the document window.

If you have not given a name to the document yet (the top line will show “Untitled”), “Save” will work in the same way as “Save as”.

If you select “Save” with the SHIFT key held down, a window appears for you to specify which parts of the scene are to be saved. Otherwise all the parts saved when you last called this function are saved.

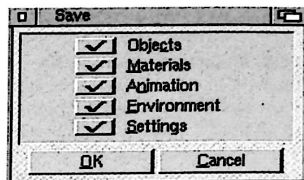
Enter in the “Save” window the parts of the scene you want saved. You can select between “Objects”, “Materials”, “Animation”, “Environment” and “Settings” (cf. Reference V.1.3.).

1.6 Save As



Picture 124

Unlike with the “Save” function, “Save as” always opens the file requester window. The filename entered here will subsequently be displayed in the top line of the document window.



Picture 125

After confirmation of the file requester window, the “Save” window opens. There you can specify which parts of the scene are to be saved. You can select between “Objects”, “Materials”, “Animation”, “Environment” and “Settings” (cf. Reference V.1.3.).

1.7 Preferences

These settings control the appearance of the editor as well as the operation of the functions.

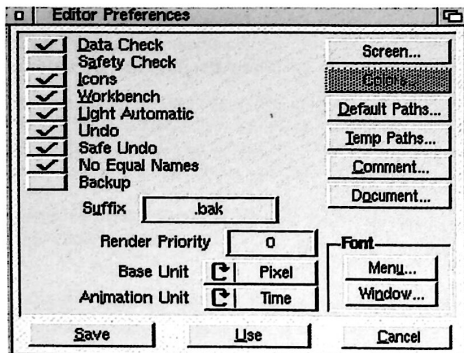
1.7.1 Editor Preferences

Here you can set the most important preferences for your work with Cinema4D.

File Safety Alerts

If “File safety alerts” are active, a safety alert will appear every time before a file is overwritten. This does not apply if the “Backup copies” option is active.

The “File safety alerts” option does not affect the “Save” function. “Save” always saves immediately, without any alerts.



Picture 126

Safety Check

If this is active, a safety alert appears with all operations which cannot, or cannot easily, be undone.

Irrespective of this setting there are several parts of the program that will always produce safety alerts. One example of this is closing changed documents.

Icons

If you do not wish an icon to be saved with each file, disable this option.

Workbench

If you do not require Workbench or your Amiga has insufficient memory to work with, you can disable the Workbench by de-selecting the “Workbench” field. The Workbench cannot be closed if it has an open CLI window or if other applications are running since the operating system will not permit this.

Automatic Lighting

Here you can specify if the automatic lighting is to be used when there is no light source.

If you start the shaded display, the scanline algorithm or the Ray-Tracer without having defined a light source, Cinema4D will render the scene using a standard light source located in the same position as the “Perspective” camera. This ensures that objects are well lit, and can be judged adequately, even while still under construction. As soon as you define one or more light sources (e.g. the environment sun), the automatic lighting is disabled.

You should use your own light sources for spectacular scenes, lighting objects from the side or from behind, to give the scene more depth. The automatic light source which is always located at the position of the “Perspective” camera only casts light on the object from the front. The absence of shadows makes the objects appear flat.

Safe Undo

The “Undo” command in the “Edit” menu is used to reverse all functions which change an object. To do this, Cinema4D creates an internal copy before executing the function, which can then be used to reverse it. If Cinema4D requires memory to be able to execute a function, and the “Safe undo” option is inactive, the program will delete the internal copy and make use of the memory freed. As a result, it is no longer possible to select “Undo”. If “Safe undo” is selected, the internal safety copy will be retained and can be restored at any time.

Undo

The “Undo” setting determines whether or not an Undo is always done or not. The advantage of disabling it is that using Cinema4D with large objects on small computers becomes noticeably faster.

Duplicates

It happens quite frequently, especially when creating objects, that duplicate names are assigned - for example, a newly generated sphere always being called "Sphere". This makes it impossible to distinguish between them in the selection of objects. When "No duplicate names" is active, the program will check that a name is not already in use and, if necessary, modify it. The name "Sphere", for example, would be changed to "Sphere.2".

The names are checked with all newly created objects and with the "Insert" function.

Backups

With this option enabled, Cinema4D will create a backup copy of all files that are overwritten during Save operations. The extender entered into the text field "Suffix" will be added to the filename.

It is recommended that you enable this option, especially when working with large documents, as you will then always be able to return to a copy of the original document.

Suffix

Here you enter the extender which will be added to the filename when a backup copy is written.

Rendering Priority

This function is used to set the priority which Cinema4D should assign to the Ray-Tracer during rendering.

In a multitasking operating system, concurrent programs are assigned different priorities. Programs with a high priority have preference over programs with a low priority and will therefore be executed more quickly. If, for example, you want the Ray-Tracer to run in the background to render a picture while you are already working on the next scene in the editor, you are advised to set the Ray-Tracer's priority to a negative value (the editor has a priority of 0). All values between -10 and +10 are valid.

Basic Unit

When pixel units are selected as the basic unit, all other units - such as cm - will generate an error message because their translation into pixel units is undefined.

Here you select the unit to be used by Cinema4D as the standard unit when outputting figures. If, for example, you select "cm" as the basic unit, all distances and positions are indicated in centimetres.

When entering such values, it is not necessary to add the unit after the figures as Cinema4D will do this automatically, using the Basic Unit selected here.

You can choose between km (kilometres), m (metres), cm (centimetres), mm (millimetres), um (micrometers), nm (nanometres) and pixels. Pixel units are simple numerical values without specification of a unit. It is up to you how you interpret this unit.

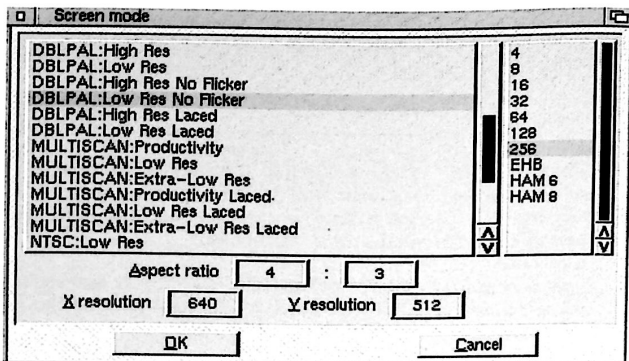
Animation Unit

Here you select whether the progression of the animation is to be indicated in pictures or in extended notation (cf. Animation tutorial 1.).

Screen

When you click on this field, a selection window for the editor's screen mode appears. Here you can set the resolution and the number of colours. All screen modes have a minimum of four colours available. HAM or HAM-8 modes can also be selected.

You can also select “Workbench” for the editor screen mode. In this case, Cinema4D does not open a screen of its own but runs on the workbench. You can therefore have Cinema4D running alongside other applications without any problems and without the need to keep switching between screens.

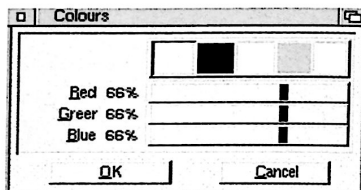


Picture 127

Since virtually all graphics cards emulate the workbench, you can run Cinema4D even with the more exotic graphics modes.

Along with the screen mode, you can also enter a resolution for the editor.

Colours



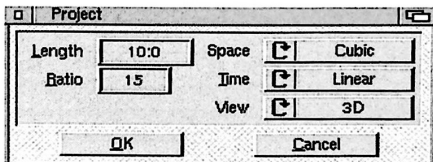
Picture 128

This function is used to set the editor colours. The field is disabled when Cinema4D is running on the workbench. Use the preferences program “Palette” to change the workbench colours.

The fifth colour in the “Colours” window can only be set when Cinema4D is run with more than four colours. This colour is used to set the colour of active objects. The change will only be noticed, however, after you have quit the window with “OK”.

Document

The “Document...” setting is used to open a window in which you can set a document’s defaults. Options available are default view to be used when a new document is opened, interpolation style for time and space, and animation length and frame rate settings. New documents will then be opened using these values as defaults.

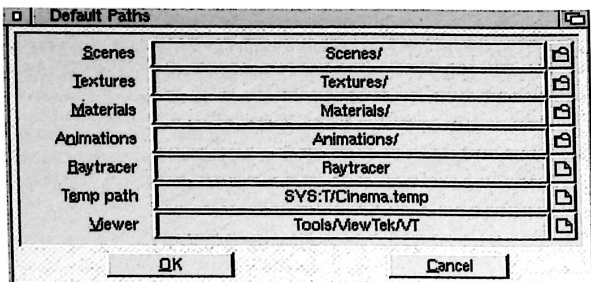


Default Paths

For systematic work with Cinema4D it is highly advisable to collect scenes, materials, textures and animations in different directories on the hard disk. For the sake of clarity, materials, for example, should be kept in a directory named “Materials”.

You can set the default paths used when the program is started in this window.

The text field “Ray-Tracer” indicates the drawer in which the Cinema4D Ray-Tracer can be found. You can leave this text field empty if it is located in the editor’s main directory.

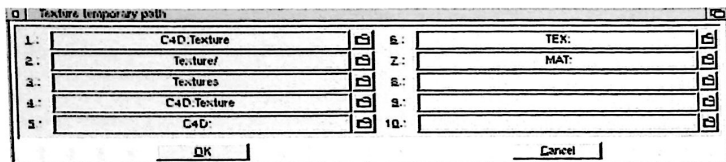


Picture 129

Under “Redirection” you enter the pathname under which the active document is temporarily saved when the Ray-Tracer is started. The default entry is always “T:Cinema.temp”. If you are short of memory, you should enter a hard disk path.

Temp Paths

A common occurrence when converting imported objects is that certain textures are not found in the specified path. Although you can correct the paths individually after rendering has started, it is rather irritating, especially when many different textures are involved.

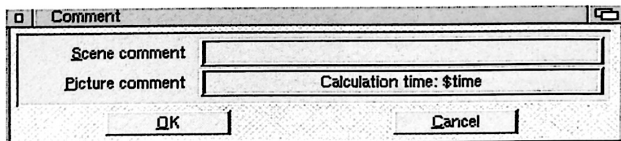


Picture 130

Cinema4D therefore offers the possibility of entering up to 10 substitute paths. When the editor or the Ray-Tracer cannot find a texture in the original path, the substitute paths will be searched automatically. An error message appears only if the texture cannot be found there either.

Comments

Here you can enter any comments to be saved along with each scene or each picture. For example, the computer configuration used, your name or an explanation.



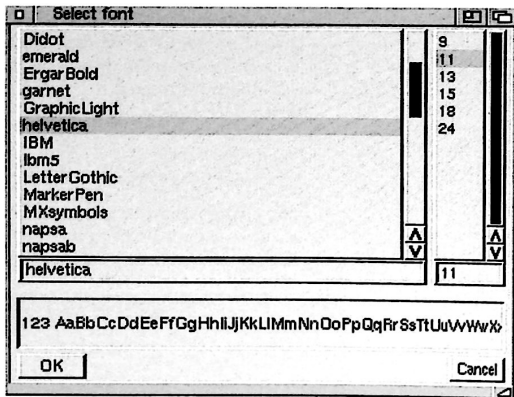
Picture 131

You can use the keyword “\$TIME” in the picture comment. Cinema4D automatically replaces this keyword with the time taken to render a picture. Thus you will be able to determine even after many weeks how long it took to render a picture.

You can view the comments attached to a file at any time. Just activate the file’s icon on the workbench and select the “Information” function from the menu. A window appears with the comment alongside the file size. Comments can also be displayed with the CLI command “list”.

Font

Here you can select your favourite font for the menus and windows. Larger fonts are more readable, but will also slow down the menus, and an excessively large font sometimes makes some menu entries unavailable.



Picture 133

When using a high editor resolution (e.g. 1024*768 pixels) on a small monitor, you should choose an appropriately large font. A good font, for example, is Helvetica at 13 points.

There is one restriction on the window font. It must not be larger than 13 points. With a smaller font, no icons will appear in the “Object Selection” and “Object Manager” windows. It is therefore best to use “Helvetica 13” or “Times 13”. With all other fonts you have to make sure that you are using fairly narrow type, or text may not fit into certain input fields.

Save

When you are sure that you want to use the changes you have made, so that whenever you start the program, your new settings will appear. Select the “Save”. button. Cinema4D will save the changes to the file “ENVARC:Cinema/Editor.prefs”, the changes will also be used for the current session.

Use

Any changes you make to the preferences can be tested first by clicking on “Use”. Your changes are implemented but not saved so that you will find the old parameters restored when you restart the program.

1.7.2 Load Display Prefs

The default setting loaded by Cinema4D at every program start is called “ENVARC:Cinema/Display.prefs”

Using this function, you can load previously saved display settings (cf. Reference V. 1.3.) from the hard disk. The file requester window will appear for you to enter the name of the settings file.

When a display is loaded, the active document is redrawn. For all inactive documents the redrawing has to be started manually.

1.7.3 Save Display Prefs as

Saves the current settings of the “Display” window (cf. Reference V.1.3.) to the hard disk. The file requester window appears for you to enter the name of the settings file. The default filename is “Display.prefs”.

1.7.4 Load Layout Prefs

This function is used to load from the hard disk previously saved layouts (arrangements of windows and icon bars). The file requester window appears for you to enter the name of the settings file.

1.7.5 Save Layout Prefs as

Saves the current layout to the hard disk. The file requester window appears for you to enter the name of the settings file. The default filename is “Layout.prefs”.

For intensive work with the program it can be helpful to save several different layouts.

The standard setting loaded by Cinema4D at every program start is called “ENVARC:Cinema/Layout.prefs”.

When saving the layout, Cinema4D only remembers the position and size of the current document. The position of other document windows is ignored.

The standard setting loaded by Cinema4D at every program start is called "ENVARC:Cinema/Render.Prefs"

1.7.6 Load Render Prefs

This function is used to load from the hard disk previously saved settings for the picture rendering algorithms. The file requester window appears for you to enter the name of the settings file. The loaded picture data are applied to the active document. The picture data of inactive documents remain unchanged.

1.7.7 Save Render Prefs as

Saves the current picture data (settings for the rendering algorithms) to the hard disk. The file requester window appears for you to enter the name of the settings file. The default filename is "Render.prefs".

The picture data comprise the current settings of the rendering algorithms. These include resolution, screen mode and all other settings made in the display modes "Black & White Wireframe" to "raytracing".

It is well worth it to save several different settings files. Lower resolutions with fewer options are better suited for rendering scenes in their early stages, while at a later stage high resolutions with enabled options are needed. If you are the owner of a graphics card, you may select the settings so that rendering is always redirected to the graphics card.

The standard setting loaded by Cinema4D at every program start is called "ENVARC:Cinema/Grid.prefs".

1.7.8 Load Grid Prefs

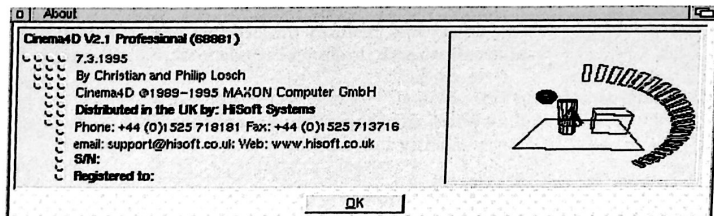
This function is used to load grid settings previously saved to the hard disk. The file requester window appears for you to enter the name of the settings file.

When a grid setting is loaded, only the active document is redrawn. With inactive documents you need to start the redraw manually.

1.7.9 Save Grid Prefs as

Saves the current grid settings (Display Grid, Move grid, Scaling grid, Rotation grid) to the hard disk. The file requester window appears for you to enter the pathname. The default filename is "Grid.prefs".

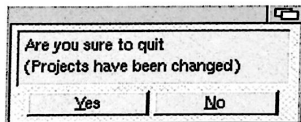
1.8 About



Picture 134

Provides information about the program, the product number, the program version, the programmers and the manufacturers.

1.9 Quit



Picture 135

Quits the program. A safety alert will always appear if any changes have been made to the documents.

2. Edit

The “Edit” menu comprises important functions for copying and deleting objects, which you will constantly need in your work with Cinema4D.

2.1 Undo

Reverses the last function which reshaped or changed the active object and restores the original object. Selecting Undo again will reverse the function itself, so that the changed object will re-appear.

When the “Time” window is open, this function applies to the currently active element in the Time window.

2.2 Cut

Removes the active object or, when editing points, the active points from the workspace and copies it or them to the clipboard. The object or the points can be retrieved from the clipboard with the “Paste” function.

When the “Time window” is open, this function applies to the currently active element in the Time window.

2.3 Copy

Copies the active object or the active points to the clipboard. The copy can be retrieved from the clipboard with the “Paste” function.

When the “Time window” is open, this function applies to the currently active element in the Time window.

2.4 Paste

Inserts the object or the points stored in the clipboard into their old position in the workspace.

When the “Time window” is open, this function applies to the currently active element in the Time window.

2.5 Delete

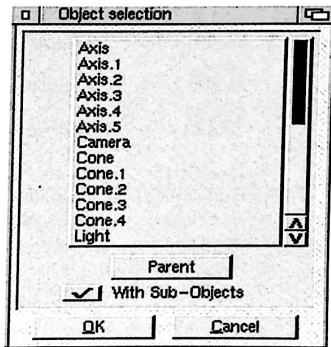
Deletes the active object or the active points.

When the “Time window” is open, this function applies to the currently active element in the Time window.

*The objects are
always listed in
alphabetical order.*

2.6 Select Object

This function is used to select objects. Only one object (including sub-objects) can be active at any one time.



Picture 136

When you select this function, a selection window appears with a list of all existing objects.

Next to the object names, icons indicating the object type will appear if you have the window font size set to 13 points or more.

The following icons might appear in the list:



Camera



Ground



Sky



Body



Sphere



Light source



Polygon



Body with sub-objects



Sphere with sub-objects



Light source with sub-objects



Polygon with sub-objects

To de-select the currently active object without selecting another, click in the blank region beneath the selection list and then on “OK”. It is important for some functions to be able to not select an object.

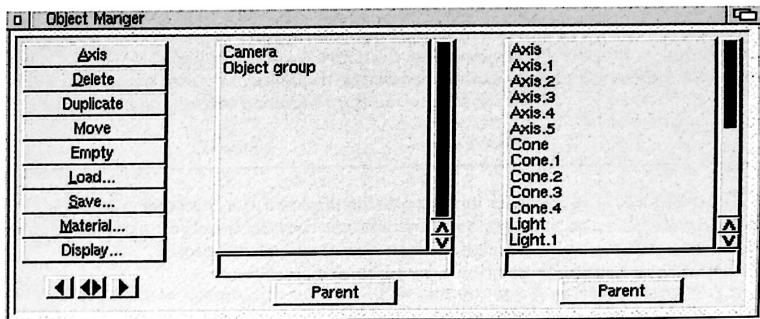
Double-clicking on an object group moves you one hierarchy level down. You return by clicking on “Higher”. Alternatively, you can click on the icon to the left of the filename, which is equivalent to clicking on “Higher”.

To select an object, you click on a name in the list and then on “OK”. You can also select the desired object by double-clicking on it, provided it is not an object group.

The “With sub-objects” option determines if, in the case of an object group, the whole object inclusive of all its sub-objects is to be activated, or only the object itself (without sub-objects).

2.7 Object Manager

This function is a powerful tool for making changes in the object hierarchy.



Picture 137

After selecting this menu item, a window with two selection lists appears. In the left list, the currently active object appears as selected.

Next to the names of the objects you will find an icon indicating the object type (cf. Reference V.2.6.).

Axis

To create an object group for several sub-objects - rather like a directory in the Amiga operating system - you click on the "Axis" field. An empty object of the Body type appears in the left selection list with the name "Axis".

Delete

Deletes the selected object.

Duplicate

This function is used to duplicate an object or an object group. To be able to distinguish it from the original, the duplicate object has an extender appended to its name. This only happens, however, if the “No duplicate names” option has been enabled in the editor settings.

It is advisable to give each object its own name. You will find it easier then to tell the difference between objects at a later date.

Move

The most important field of the Manager window is “Move”. This function removes the selected object from the selection list and inserts it in the selection list opposite.

It is not possible to move an object group into itself.

An example will illustrate this: Let us assume you have created the objects “Jet 1”, “Jet 2”, “Wing” and “Body” for an aeroplane. You now wish to combine these parts into an object group.

- Click on “Axis” and change the name in the text input field below the selection list to “Aeroplane”.
- Double-click on “Aeroplane” in the left selection field. The left list is empty as this does not yet contain any objects.
- Now activate the object “Jet 1” in the right list and select “Move”. The object disappears from the right list and can now be found in the left list. Repeat this procedure for the remaining objects until they are all in the left list, i.e. in the object group “Aeroplane”.
- All that remains in the right list is the name “Aeroplane”, the contents of which can be seen in the left list.

Empty

It sometimes happens that you no longer require an object group. You could, of course, move all the sub-objects one-by-one from the object group to a superior hierarchy, but that is very time-consuming.

The “Empty” function makes this much simpler by automating it. It moves all sub-objects of the selected object one hierarchy level up.

If you wish to rename an object, you can do this in the text fields below the selection lists. These always indicate the name of the selected object and will let you edit it. You must leave the text field with

<RETURN>

for the changes to be accepted.

Object names can be a maximum of 15 characters long.

Any further characters are ignored.

Insert

This function is used to reload previously saved objects. The file requester window appears for you to enter the name of the object. It does not matter whether it is an object file or an entire scene. Cinema4D will load all objects contained in the file into memory and ignores all other data (e.g. settings and environment). The new objects are added to the left selection list.

Save

Clicking on this function saves the selected object to the hard disk. The file requester window appears for you to enter the pathname for the object.

Material

This function is identical with the “Select material” function in the “Edit” menu and applies to the selected object in the list. In the case of an object group, the material - following a safety alert, if necessary - is also assigned to all sub-objects.

Parent

This function moves you from one hierarchy level to the next higher one. Nothing happens if you are already on the highest level.



Moves the contents of the right list to the left list.



Exchanges the contents of the left and the right lists.



Moves the contents of the left to the right list.

2.8 Select Material

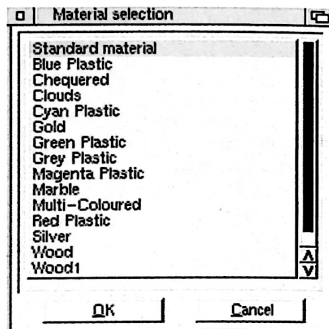
The materials are always listed in alphabetical order. The one exception is the standard material which is always listed first.

Newly-created objects are automatically assigned a white standard material by Cinema4D. This function allows you to assign a different material to the active object. You can use the supplied as well as your own materials.

When you call this function, a selection window with a list of all materials appears. The material assigned to the active object is marked.

To select a material, just click on its name in the list and then "OK". You can also double-click on the name of the material.

If the object and its sub-objects are active, the selected material will also be assigned to the sub-objects. If the safety alerts have been enabled, the program will check before doing this out.



Picture 137

To create new materials or load new materials, use the “Material Manager” function.

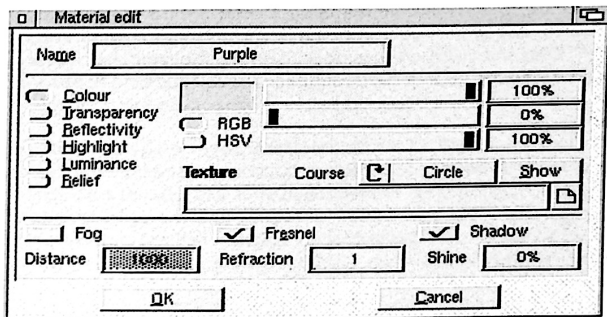
When using an editor screen mode with less than 8 colours or the Workbench, setting the material colours can lead to strange colour effects on the desktop. These will disappear as soon as you leave the window.

2.9 Edit Material

This function is used to completely edit and change an individual material. Please read more about this in the Basic, Chapters 14 (The Light Model) and 16 (Materials and Textures).

When you select this function, several things may happen:

- If the active object has been assigned the white standard material, Cinema4D will branch to the “Select material” function as the standard material cannot be edited.
- If the active object has been assigned any other material, the “Edit material” window is opened.



Picture 138

Name

Enter the name of the material here. It can consist of a maximum of 23 characters.

RGB-HSV Selection Group

Here you can toggle between the RGB and HSV colour models (cf. Basics 15.0).

Attributes Selection Group

Here you select which surface parameter of “Colour”, “Transparency”, “Reflectivity”, “Highlight”, “Luminosity” or “Refraction” is to be changed by using the sliders and text input fields. If, for example, you wish to change the transparency of a material, you click on “Transparency”. The sliders and text input fields will then automatically indicate the transparency colour and the corresponding texture settings.

As soon as you enter something into the text field “Texture”, a texture is used. To disable a texture, therefore, you need to delete the contents of the text field. You can use “Show” to have the texture entered into the text field displayed. In addition, you are given the values for texture width, texture height and texture depth. You set the texture graduation with the “Graduation” selection field. This is explained a little further below.

The sliders have a slightly different meaning with the “Refraction” surface parameter. Here, the top slider sets the refraction strength. Like all colour values, it can range from 0% to 100%. The other two sliders are disabled in the meantime. It does not matter whether you have selected “RGB” or “HSV”.

Colour

Here you set the colour and colour texture of the material. The colour selected here will be used for all parts of the object that are not covered by a colour texture.

Transparency

Enter the three transparency percentages and the transparency texture of the material. A percentage of 0% for an RGB component means that the material is not transparent for this colour component, while a setting of 100% means full transparency. All parts of an object that are not covered by a transparency texture will be assigned the transparency defined here.

The transparency of a material can only be rendered by the Ray-Tracer.

You can visualise a transparency texture as a colour slide. The red parts of the slide, for example, will only allow red light to pass through, while the white parts allow all light through. No light at all passes through the black parts of a colour slide.

Reflectivity

Enter the three Reflectivity percentages and the Reflectivity texture of the material. A value of 100% for one of the RGB components means that the material reflect all of that colour, while a value of 0% means that there is no reflection at all. All parts of an object that are not covered by a reflection texture will be assigned the reflection defined here.

A material's reflection can only be rendered by the Ray-Tracer.

The values set for reflection determine for the entire surface how much the three colour components red, green and blue are reflected. A reflection texture determines the reflection for each individual point of the texture picture differently. This enables you to create very complex surface effects. If, for example, a chequered pattern of alternate black and white squares is used as a reflection texture, you can create the effect of a non-reflective surface wherever the black squares are located, while all other parts are 100% reflective. This looks like a pattern of alternate non-reflective and reflective tiles.

Highlight

Here you can define, for each colour component separately, which colour or texture is to display the highlight. Plastics, for example, always have a white highlight, while some metals like brass or bronze have yellowish highlights. All parts of an object that are not covered by a highlight texture will be assigned the highlight colour set here. The strength of the highlight is set under “Shine”.

Very interesting animation effects can be generated with a highlight texture. If the highlight travels across the surface of an object during an animation, it can assume different colours in the process.

Shine

Here you can determine if the surface is to look matt (10%) or polished (100%). The larger the value, the larger the highlight. Metal, for example, has a value of 30%, glass 40%. To disable the highlight, enter a value of 0% (rough timber, for example, has no highlight).

Luminance

A (self-) luminous material is not a light source. Other objects are not lit by it. Also, no additional shadows are generated.

A luminous surface always has the same light intensity, irrespective of how many light sources are present and from what direction light is cast. Here you can set which “base colour” an object will always have. You can use this function to, for example, simulate a neon advertisement.

All parts of an object not covered by a radiant texture are assigned the radiant colour defined here.

Relief

When using a relief you must specify a texture as this can only be calculated from a picture’s grey values.

The strength of the relief can be set by using the top slider. This value indicates how much the normal vectors deviate from their original direction when the relief is rendered. The higher the value, the rougher the surface. Be careful with excessively large values, however, since the textures will cease to look pleasant as a result of the big lighting leaps. A value of 20% should be sufficient in most cases.

Rendered profile



Graduated Brightness



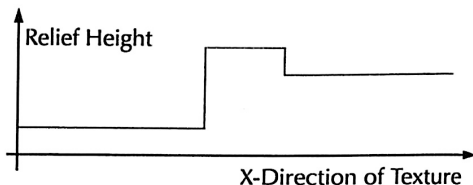
Picture 139

Picture 139 shows a level surface from the side. Since the same normal vector is used for lighting the entire surface, the surface has an even brightness. If instead you are using a relief texture, Cinema4D will interpret the picture's brightness values as height values for the surface, as you can see in Picture 140. These height values are converted into a profile, the incline of which influences the angle of the normal vectors. Although the surface is really flat, the angle of the normal vectors leads to the rendering of an apparently three-dimensional surface with a relief-like structure, and a brightness gradient as in Picture 140 below.

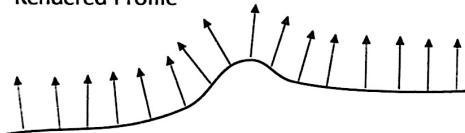
Texture

If, for example, you wish to use a colour texture, you need to first click on "Colour". Then you enter the location of the picture on the hard disk. To check that you have entered the right picture you can have a test display of it, by clicking on "Show". Cinema4D loads the texture into memory and displays it on screen. End the display with a mouse click. Cinema4D will also show the width, height and colour depth of a texture in a window.

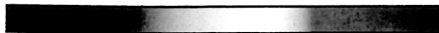
Relief Texture



Rendered Profile



Brightness Gradient



Picture 140

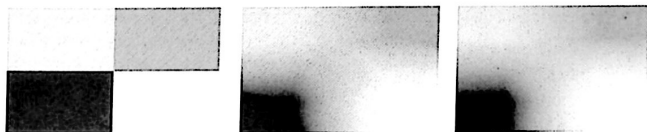
Cinema4D can render textures with an 8-bit colour depth particularly quickly. If speed matters to you, it is advisable to convert all textures to an 8-bit colour depth using a graphics program. Please note, however, that textures with a lower original colour depth will then require considerably more storage space.

Cinema4D can load all pictures in the IFF-ILBM format. It does not matter if the pictures were saved in a special screen mode such as Extra-Halfbrite or HAM, or have different numbers of bitplanes. Cinema4D will happily handle pictures with a colour depth of 1, 2, 3, 4, 5, 6, 7, 8, 12, 15 and 24 bits, at any resolution and any screen mode. Therefore it will even load HAM pictures.

Graduation

Here you select how the points of a texture are interpolated. If, for example, you are using a colour texture of 2*2 pixels and place it on a very large area, one pixel of the texture may well cover several screen pixels of the rendered picture.

To prevent the use of the exact colour points as in Picture 141, you can switch the graduation from "Square" to "Circle" (Picture 142) or "Star" (Picture 143). Dependent on this setting, Cinema4D will then interpolate in a more circular or linear fashion. You can therefore create very soft colour graduations.



Pictures 141, 142 143

Normally the "Circle" graduation is enabled for all textures, since this method produces the best graduations.

Fog

This option is used to simulate realistic fog or gas clouds. Objects with such materials are translucent but, dependent on their strength, weaken the light shining through them.

When the fog option is enabled for a material, attributes such as highlight, reflectivity etc. are disabled as they are physically impossible. You can only set the fog colour and distance.

A light beam entering the fog will be weakened. You can define this weakening with “Distance”. The larger this value, the thinner the fog. “Distance” indicates at what distance the light beam will be completely exhausted.

In addition to the weakening of the light, the fog’s own colour is blended into it. The further you look into the fog, the less visible objects are, but the stronger the fog’s colour will become. At the distance set with “Distance”, the fog colour will be blended into it at 100%.

Please note that fog objects can only be rendered by the Ray-Tracer. The “Fog” and “Transparency” options must have been activated in the “Raytracing” window and the rendering depth must be at least 2.

If, for example, you define a “Distance” of 500, a light beam of originally 100% intensity will only have an intensity of 50% after 250 units, and expires after a further 250 units. The shorter the distance, the thicker the fog appears. In addition, half the fog colour is blended into it after 250 units, and the full colour after 500 units.

Cinema4D always assumes that the camera is located outside the fog. When the camera is positioned inside an object with fog material, Cinema4D will render the picture as if there were no fog inside the object, but everything outside the object was in the fog. It would require impossible processing power, unfortunately, to determine if the starting point of a camera ray is located within or without an object. Also, consider a half-open spherical bowl - what’s inside or outside in that case?

When fog objects overlap each other, the intensities behind the overlapping area are weakened by both fogs simultaneously. The same applies to fog inside another fog object.

Fog objects can be used for the representation of smoke, mountain mists, clouds or spotlight effects.

Fog objects should always be closed volume bodies. Non-closed objects can lead to physically faulty pictures since a light ray that has entered the object will not encounter its surface again. The Ray-Tracer will then assume that the light ray is still inside the fog.

Fresnel

When Fresnel is disabled, the values entered for “Transparency” and “Reflectivity” will be used irrespective of the viewing angle.

Otherwise, the angle between the light ray and the surface is used to calculate transparency and reflectivity. If, for example, you are viewing a pane of glass, you will notice that the glass allows almost all light to pass through and is almost non-reflective when viewed vertically. However, if you look at it (or a lake, for example) from a shallow angle, it will reflect the entire environment and objects located below it are invisible. The relationship between transparency and reflectivity changes smoothly between these two viewing positions.

As a further example, if you have entered the RGB values of 80% red, 80% green and 80% blue for transparency at a refraction index of 1.5, the material will be 80% transparent and 0% reflective when viewed vertically. Any values greater than zero entered for reflectivity will be added to the angle-dependent values.

Refraction

Here you enter the refraction index of a material. This only makes sense, of course, for transparent materials, otherwise the refraction index is ignored. Some examples of refraction indices are:

Material	Refraction index
Vacuum	1.000
Air	1.000
Water	1.333
Quartz glass	1.458
Benzole	1.501
Crown glass	1.510
Amber	1.550
Flint glass	1.613
Diamond	2.419

Objects that are not completely closed, such as a hemisphere or a single triangle, can produce anomalies in the picture. This is a result of the method by which the Ray-Tracer calculates transparency and refraction. When a ray meets a surface with transparency and refraction, it is weakened and deflected as it passes through the surface. The ray is now inside the object and continues until it encounters once again an object surface, this time on the exit side. There it is deflected again, just as one would expect from a refracting object, like a glass sphere for example.

If, for example, you are using an open hemisphere, the ray will enter the hemisphere but might never encounter a second surface. The Ray-Tracer will then assume that the ray is still inside the hemisphere, even though it is already outside. Do not be surprised, therefore, to obtain unexpected refraction effects when using open objects, change the objects so that they are closed. You could, for instance, give a second wall or a lid to an open hemisphere.

Shadow

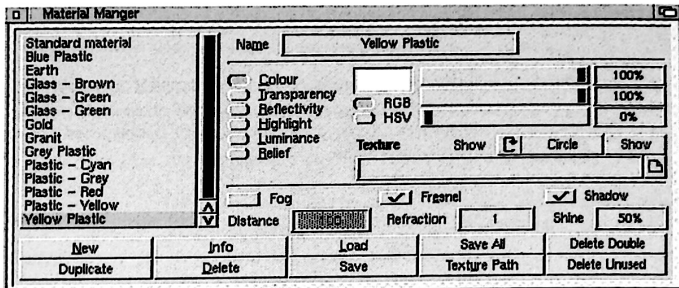
This option is used to determine if shadows are to be rendered on the surface of a material. Sometimes shadows on an object are undesirable and here you can decide if this material has shadows cast on it.

To render an entire picture without shadows, make a global setting in the “Raytracing” window. The “Shadow” option is not intended for this purpose.

2.10 Material Manager

This function is used to generate new materials, load materials from the extensive materials library or delete materials.

You will immediately notice the absence of the “OK” and “Cancel” fields that are otherwise always present in the program. All changes to materials are entered in this window directly, and a value is saved as soon as it has been changed.



Picture 144

The “Material manager” window contains a selection list with all available materials. To the right of the list, you find the same buttons as in the “Edit material” function. They indicate the values of the material activated in the selection list. The purpose of these buttons is explained in the section “Edit material” (cf. Reference V.2.9.).

New

This function is used to create a new material. The new material is a copy of the white standard material.

Duplicate

This is used to duplicate a material. An exact copy of the marked material is created, and the selected material remains selected.

Info

To enable you to find out whether a material is used by another object, or how many other objects have been assigned this material, select the “Info” option. It tells you the number of objects, including Ground and Sky, which make use of the selected material.

Delete

Select this function to delete a material from the list. Please note that a material can be assigned to several objects. If you delete a material, these objects may be assigned the standard material as a result.

Insert

This function is used to reload previously saved materials. The file requester window appears for you to enter the pathname of the file to be inserted. It does not matter if it is a material file or an entire scene. Cinema4D will load all materials contained in the file, and ignore all other data.

The new materials are added to the selection list.

Save

This function is used to save a single material to the hard disk. The file requester window appears for you to enter the pathname under which the material is to be saved.

Save all

This function saves all materials shown in the list. The file requester window appears for you to enter the pathname under which the materials are to be saved.

Texture Paths

This function exists so that you can avoid having to correct wrong texture paths for each material individually.

When you select this, a window appears for you to enter the new texture path. This texture path is activated for all textures. Thus, the path for “dh0:Pictures/Backgrounds/Pics/KingTut” could become “Tex:KingTut” when you have entered “Tex:” as the new path.

Delete Duplicates

If you are in the habit of inserting materials or objects with materials - perhaps taken from entire scenes - certain materials may well be present several times. This function deletes all duplicate materials. A safety alert will always appear.

Objects which have been assigned one of the deleted materials will instead be assigned the remaining material.

Delete Unused

This function deletes all unused materials in a document. A safety alert will always appear.

2.11 Select

2.11.1 All

Activates all objects in a document. Since Cinema4D only allows one object to be active at any one time, a new object group "World" is generated at the highest hierarchy level. All existing objects are combined into this object group.

This function has a different meaning when you are editing points. All points of the active object are selected instead.

2.11.2 None

It is sometimes necessary to de-activate all objects. Select "None" to do this.

This function has a different meaning when you are editing points. All points of the active object are de-selected instead.

2.11.3 Invert

When editing points, you can use this function to invert the point selection: all active points are made inactive, all inactive points are activated.

2.11.4 Group

This function is used to combine objects into an object group. When you select this function, the mouse pointer changes into a cross-hair cursor. Now draw up a frame with the left or right mouse button around the origins of the objects which are to be combined into a group.

The newly created object group is always on the highest hierarchy level.

You can abort the framing with the opposite mouse button.

When framing a hierarchical object with sub-objects outside the frame, the entire object will still be inserted into the new group, since hierarchies are not altered. You can prevent this by pressing the SHIFT key when drawing up the frame, so that only those objects whose origins lie within the frame will be grouped.

2.12 Hierarchy

This function is used to navigate quickly and easily through a scene's object hierarchy. There is no need to click on objects or to call the "Select objects" function.

2.12.1 Forward

Selects the next object on the same hierarchy level, if present. If no object is selected, the first object on the highest hierarchy level is activated.

2.12.2 Back

Selects the previous object on the same hierarchy level, if present. If no object is selected, the first object on the highest hierarchy level is activated.

2.12.3 Higher

Selects the object located one hierarchy level above. Nothing happens if there is no object at the higher level. If no object is selected, the first object on the highest hierarchy level is activated.

2.12.4 Lower

Selects the object located one hierarchy level down (sub-object). Nothing happens if there is no object at the lower level. If no object is selected, the first object on the highest hierarchy level is activated.

3. Objects

All newly created objects, except polygon objects, always appear centred in the workspace (different rules apply to the polygon objects).

Cinema4D offers an extensive array of objects that can be used to create all kinds of scenes. The objects are divided into different groups - from the simple primitives to the powerful polygon objects. Special objects for the automatic generation of texts or mountain ranges are available as well as a function to create an animation-ready figure.

A general rule applying to all objects is that you can only change parameters during their creation if you call the relevant function with the SHIFT key held down. Otherwise the object is created immediately.



3.1 Primitives

The primitives are described in the section on the Object Tools window (cf. Reference II.3.).



3.2 Polygons

The polygons are described in the section on the Object Tools window (cf. Reference II.4.).



3.3 Polygon Objects

The polygon objects are described in the section on the Object Tools window (cf. Reference II.5.).



3.4 Special Objects

The special objects are described in the section on the Object Tools window (cf. Reference II.6.).



3.5 Ground

This is used to enable and disable the Ground. The tick against the menu entry indicates that the Ground is present.

The Ground is described in the section on the Object Tools window (cf. Reference II.7.).



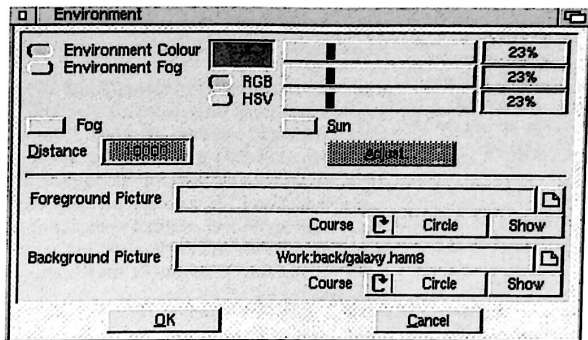
3.6 Sky

This is used to enable and disable the Sky. The tick against the menu entry indicates that the Sky is present.

The Sky is described in detail in the section on the Object Tools window (cf. Reference II.8.).

3.7 Environment

Here you can set several global scene parameters.



Picture 145

Environment Colour

The environment colour is the colour of the environment light. The environment casts an even, diffuse light on the scene from all sides and simulates the background brightness of the daytime Sky or the indirect light from room lighting.

The environment light does not cast shadows, since it casts light evenly from all sides. Nor does it slow down rendering.

As a general rule, the environment light should correspond to the colour of the light source used, but deviations from this are conceivable. You could, for example, select a murky blue to simulate a night, but have the window of a house illuminated by a warm yellow light source.

Set the colour with the sliders, or enter the appropriate numerical values into the fields next to the sliders. The input will be interpreted according to the RGB or HSV model, depending on your selection (cf. Basics 15.).

With an environment fog active, neither a background picture nor the Sky are visible.

Fog Colour

Here you can select the colour of the environment fog. The environment fog is activated with the “Fog” option. It fills the entire scene and expands infinitely. “Distance” is used to set the thickness of the fog by indicating the distance over which a light ray loses all its intensity in the fog and has the full fog colour added to it. If, for example, you enter a “Distance” of 500, a light ray with an original intensity of 100% will only have an intensity of 20% after 400 units, and expires completely after a further 100 units. The shorter the distance, the thicker the fog appears.

The sun activated here is only used for picture rendering and not visible in the editor.

The environment fog fills the entire scene and expands infinitely. Since rays entering into the environment fog further than the “Distance” are completely extinguished and assume the fog colour, you cannot see a Sky or a background picture when the environment fog is active. You can use the environment fog for moody autumn pictures or underwater scenes.

The environment fog is rendered by the scanline algorithm and requires little rendering time.

Sun

The picture selected here is always positioned over the rendered picture in an exact fit. Pictures that are too large will therefore be reduced, and smaller pictures enlarged.

This is used to activate a sun in addition to other existing light sources. You find a detailed description of the individual parameters in the section on the “Sun” function (cf. Reference II.6.4.). The difference between the “Sun” function and the sun selectable here is that the latter is easier to animate. A normal light source created with the “Sun” function can be animated with all its parameters, but this is a more involved procedure. Here all you need to do is to define the start and end time and the scene will instantly be lit. To animate the sun, disable the automatic lighting in the editor settings. Otherwise the scene will be lit by the automatic light source after sunset.

You can generate particularly impressive copyright notices by making Cinema4D render the selected font 3D. Create the text using the "Text" function, then place it at reduced size in a corner of the picture and use the rendered picture as the foreground picture.

The background picture is only visible where there is no object, Sky or Ground. The picture selected here is always placed into the background at an exact fit. A picture that is too large will therefore be reduced and a smaller picture enlarged.

Foreground Picture

You can place a foreground picture in front of any picture that is rendered by the scanline algorithm or the Ray-Tracer. This could, for example, be the internal view of a cockpit or simply a copyright or authorship notice which you want displayed at a particular position.

This picture will not, however, be reflected by a reflective object, nor will it light the scene in any way. It will not change when the camera setting is changed.

The scene behind it will show through all parts of the foreground picture with the colour 0. If the colour depth of the foreground picture is greater than 8-bit (e.g. 16 bit or 24 bit), then this will happen at all parts with a colour value of 0,0,0 for red, green and blue. If you need to use the colour black in the foreground picture, you need to marginally increase one of the three colour components, for instance 0,0,1. The human eye can hardly discern this with 256 colour levels.

You can enter the name and path for the picture directly into the "Foreground picture" text field. "Graduation" can be used to define the texture gradient (cf. Reference V.2.9.). To check that you are using the correct picture, you can have the foreground picture displayed by clicking on "Show".

Background Picture

You can place a background picture behind any picture that is rendered by the scanline algorithm or the Ray-Tracer. The picture will simply be positioned behind the scene but not affect it in any other way. It will not be reflected by a reflective object, nor will it show through a transparent object. It will not change when the camera setting is changed. It is comparable to a background picture created with a genlock, upon which the normally rendered picture is placed.

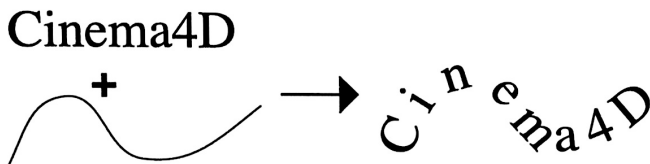
You can enter the name and path for the picture directly into the “Background picture” text field. “Graduation” can be used to define the texture gradient (cf. Reference V.2.9.). To check that you are using the correct picture, you can have the background picture displayed by clicking on “Show”.

4. Tools

The dimensions are measured along the X axis of the Object Co-ordinate System. Exceptionally, this function does not use the “View” axis.

4.1 Arrange

This function is used to arrange an object group along a spatial path. To do this, Cinema4D first determines the dimensions of the object group along the X axis of the Object Co-ordinate System. Then it determines the relative X-position of each (sub-) object in relation to the total dimensions of the object group. The new position and location on the spatial path is then calculated from these relative positions.



Picture 146

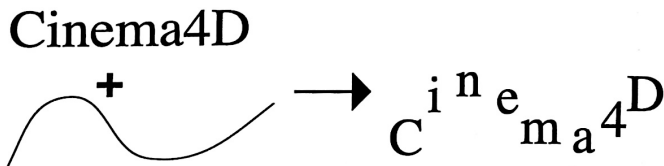
Imagine, for example, the object group “Cinema4D” consisting of a series of individual three-dimensional letters created with the “Text” function in the “Special objects” menu (Picture 146). This text lies on the XY plane of the World Co-ordinate System. The axes system of the object group lies parallel to the World Co-ordinate System.

You have also created a polygon that looks like a flat “S”.

If you now select “Arrange”, Cinema4D will calculate for each letter the relative X-position in relation to the entire object group. The letter “C”, for instance, has the relative position 0%, the “e” the position 43% and the last letter “D” the relative position 100%.

Therefore Cinema4D will place the first letter “C” at the beginning of the polygon, the “e” in the middle and the “D” at the end of the polygon.

The result is a text string following the curvature of the polygon (Picture 147).



Picture 147

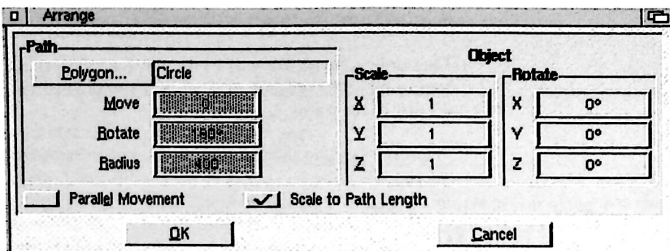
The objects are rotated, moved and scaled as one. Use the “Wrap” function (cf. Reference V.4.9) if you need to change the individual points of the active object.

The arrangement algorithm used by Cinema4D is fairly difficult to understand. If you do not want to know how exactly the program works, you can just skip this section.

The X axis of the relevant object is always rotated so that it is tangential to the path. The following arrangement rules apply to the object at the beginning of the path:

- The Z axis of the contour is rotated so that it lies in a plane parallel to the XY plane of the path-Object Co-ordinate System. If, for example, you arrange a contour along the predefined “Circle” polygon, the Z axis of the contour will be on the plane defined by the circle.
- The Y axis of the contour is positioned so that it points in the direction opposite to that of the Z axis of the path.

The start position of the first object is then rotated in such a way that the X axis always points in the direction of the path tangent.



Picture 148

Polygon

Here you can define a polygon path to be used as an alternative to the predefined one. The input fields for “Movement”, “Rotation” and “Radius” will then be disabled.

To do the reverse, click on “polygon” and select nothing in the object selection list. You do this by clicking on the blank space below the list and then clicking on “OK”.

Movement, Rotation, Radius

If you have not selected a path polygon, you can fall back on the predefined “screw” path, which winds around the Y axis of the World Co-ordinate System. “Rotation” defines the screw’s rotation angle. Enter 720 degrees, for example, for two full rotations. “Movement” defines by how much the screw is moved into the Y direction. “Radius” defines the X position at which the screw path begins.

Parallel Movement

Normally objects are rotated so that they follow the course of the path. To prevent this, select "Parallel movement". The objects will then be moved only and not rotated.

Scale to Path Length

Select this option to adapt the object to the length of the path.

Object

In addition to arranging the objects along the path, you can also change them in their Object Co-ordinate System

"Scaling" is used to specify, separately for each of the three components, whether the objects are to remain unchanged when arranged on the path (1.0) or whether, for example, they are to be shrunk to half their size (0.5). Entering the factor 0.5 for all three components will make the objects increasingly smaller towards the end of the path. The scaling is done in the Object Co-ordinate System.

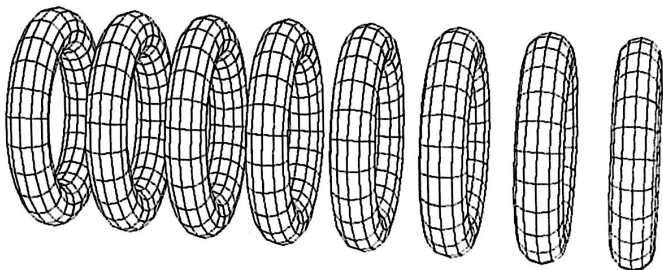
"Rotation" is used to rotate the objects around their three local spatial axes. If, for example, you enter an angle of X=360 degrees, Y=0 and Z=0, and the screw path is used, the arranged objects will not only move along the thread of the screw but additionally rotate around the path. The rotation sequence is X, Y, Z.



4.2 Boolean Operations

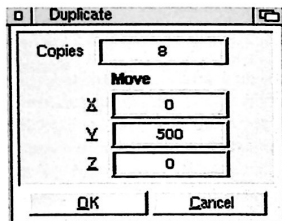
The four Boolean operations are described in the section on the Object Tools window (cf. Reference II.2.).

4.3 Duplicate



Picture 149

This is used to duplicate an object as often as required. The newly created objects can be arranged in a line (Picture 149).



Picture 150

Copies

Specifies how often the object is to be duplicated. The number 3, for instance, means that three copies are made of the active object, so that you end up with a total of four objects.

Movement

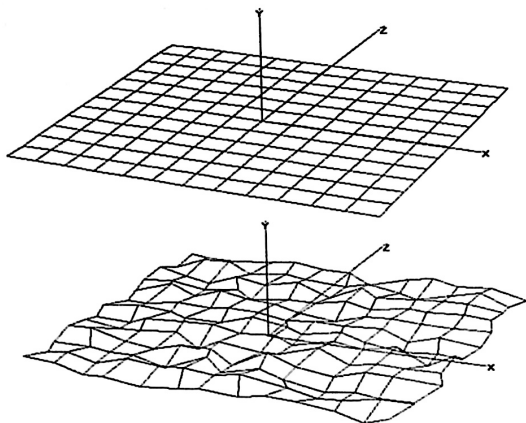
Here you enter the direction in which the duplicated objects are to move.

“The “Duplicate” function can also be used to generate complex objects such as a winding staircase. This can only be done in two separate steps, however.

First you duplicate the stairs as often as is required. You need to enter a movement in the direction of the local X-axis of the stairs. The amount of the movement does not matter.

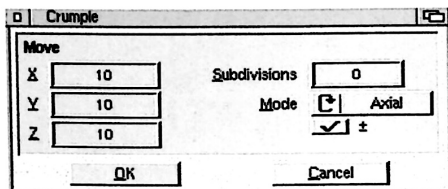
Then you select the Arrange function. Enter the screw path of the winding staircase. You need to ensure that “Scale path” is disabled - and the winding staircase is complete.

4.4 Crumple



Picture 151

It is often desirable for the simulation of realistic objects to replace the smooth mathematical appearance with a certain roughness and irregularity (Picture 151). A handkerchief, for example, should look a little crumpled. The “Crumple” function can achieve this by moving each point of an object by a random amount.



Picture 152

Mode

Here you can specify whether the random movement is to be uniform in all three directions (axial) or centric (radial) from the origin of the object.

Movement

The values for the X, Y and Z components indicate how strong and in what direction the movement is to be. A value of (0,10,0) means that the random movement will occur only in the Y direction by a maximum of 10 units.

With the radial crumple, the Y and Z components are disabled and the X component indicates the radial movement.

Subdivisions

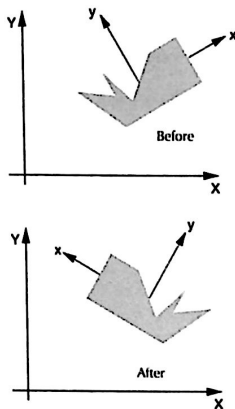
In the case of a body you can let it be subdivided at the same time. This is basically identical with the “Subdivide” function (cf. Reference V.4.7.) but offers the possibility of generating fractal structures when combined with the Crumple. The basic principle of fractal mountains or clouds is the finer subdivision of coarse structures, and the random movement of the subdivisions by a certain value. Then the subdivision is repeated, with the movement being only half as strong this time. This procedure can be repeated as required (apart from memory limitations) until a simple square has been transformed into a complex fractal mountain range with many cliffs, canyons etc.

This is exactly what Crumple does. With each step in the subdivisions, the points are moved by a random value which is half as much as the previous maximum. The first maximum value is the one entered under “Movement”.

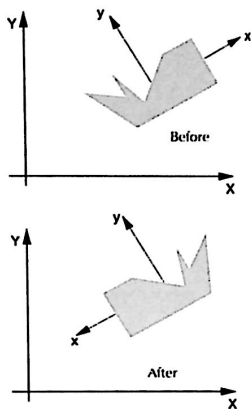
If you enter a value of Zero for “Subdivisions” the object will only be crumpled.

Selecting this option causes the movement to occur only in the positive direction up to the maximum value. You can therefore ensure that a sphere, for example, is only radially crumpled towards the outside but not the inside.

4.5 Flip

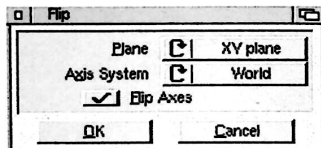


Picture 154 (global)



Picture 155 (local)

This function is used to flip an object on one plane.



Picture 153

“Plane” is used to select the plane on which the object is to be flipped. You can choose between the “XY plane”, the “ZY plane” and the “XZ plane”.

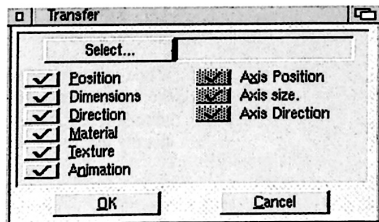
The field “Axis system” is used to specify whether the planes of the global World Co-ordinate System (Picture 154) or the local Object Co-ordinate System are to be used. “Flip axes” indicates whether the axes of the active object are to be flipped, too.

If this is the case, the Z axis of the object is flipped into its opposite direction after the flipping of the object itself. The reason for this lies in the right-hand system resulting from the Flip operation. To be able to understand this, use the first three fingers of your left hand to represent the axes of an object.

The thumb points in the X direction, the index finger in the Y direction and the middle finger points vertically in the Z direction. If, for example, you now flip on the XY plane, the X axis would simply flip over. You cannot represent this with your left hand because the left-hand system has become a right-hand system. Cinema4D, however, requires right-angled left-hand systems for all functions. This is why the Z axis is flipped at the end. Now it is a left-hand system once again!

4.6 Transfer

It is sometimes desirable that an object assumes the same position or dimensions as another object. This function can be used to transfer the properties of another object.



Picture 156

You can specify which properties of another object are to be adopted. You must further indicate from which object the parameters are to be taken. Clicking on “Select” opens the object selection window. You can select an object from this list by clicking on it.

Position

When you select this option, the active object is moved to the same position as the selected object.

Dimensions

When this option is selected, the active object is scaled so that its axes have the same dimensions as those of the selected object.

Direction

When this option is selected, the active object is rotated so that its axes have the same position as the selected object.

Axis Position

When this option is selected, the active object is assigned the axis position of the selected object. This option has no effect when “Position” is selected because “Position” already incorporates this function.

Axis size

When this option is selected, the active object will be assigned the axis dimensions of the selected object. This option has no effect when “Dimensions” is selected because “Dimensions” already incorporates this function.

Axis Direction

When this option is selected, the active object is assigned the axis direction of the selected object. This option has no effect when “Direction” is selected because “Direction” already incorporates this function.

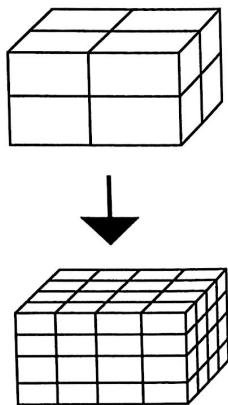
Texture

When this option is selected, the texture of the selected object is transferred to the active object. The texture of the sub-objects remains unchanged.

Animation

When this option is selected, all animation tracks of the selected object are transferred to the active object. Any existing tracks of the active object are deleted. The animation of sub-objects remains unaffected.

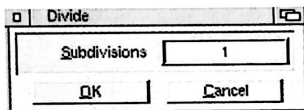
4.7 Subdivide



Picture 157

Please note that the memory requirement for each object quadruples with each subdivision. Before carrying out this function, Cinema4D will check for sufficient memory space and issue a warning, if necessary.

This function subdivides the triangles and squares of the active object into smaller triangles and squares (Picture 157).



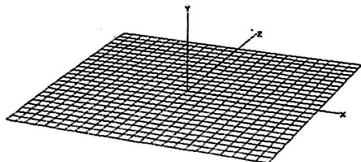
Picture 158

Subdivisions

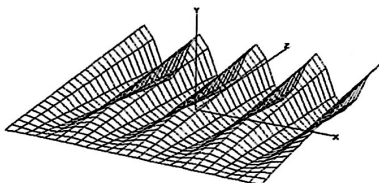
This factor indicates how many subdivisions are to be executed. One single subdivision makes four smaller triangles out of each triangle, and four smaller squares out of each square.

This function is particularly suited for objects that are to be edited using the “Crumple”, “Wrap” and “Distort” functions.

4.8 Deform



Picture 159



Picture 160

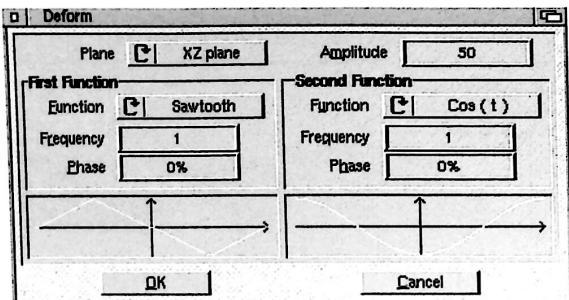
This function is used to distort the surfaces of objects according to mathematical functions. You can, for example, distort a plane with a cosine function in order to obtain a wavy water surface (Picture 159 and Picture 160). Many such functions are available, and they are represented by a curve in the window.

To distort the surface of an object, you must first specify the plane on which the distortion is to take place. If, for example, you have created an object on the XZ plane, it is sensible to enter the XZ plane for the distortion.

Since a plane always contains two spatial directions, you can select a second function to distort the points of an object in vertical direction.

Cinema4D first determines the dimensions of the active object in the Object Co-ordinate System. Then the program calculates the position of each point relative to the dimensions. For example, a point in the middle of the plane has the co-ordinates ($t1=50\%$, $t2=50\%$). Next the function values for $t1$ and $t2$ are calculated and multiplied both with each other and with the amplitude. This value determines the movement in a vertical direction from the specified plane.

You can see in Picture 161 how the plane has been distorted using a cosine function along the X axis and a straight along the Y axis.



Picture 161

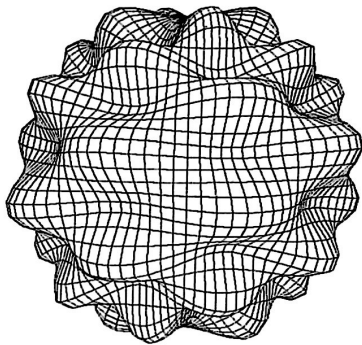
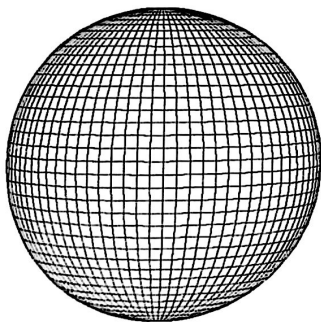
Plane

Here you can select the plane in the Object Co-ordinate System, relative to which the points of an object are to be moved by the two functions. The movement always takes place vertically in relation to the selected plane.

You have a choice between “XY plane”, “ZY plane”, “XZ plane”, “Cylinder” and “Sphere”.

The last two choices always move the points radially away from the origin of the object. The first function will always operate in parallel to the equator, and the second in a longitudinal direction on the surface of the sphere, or the long axis of the cylinder.

The “Sphere” setting is especially useful if you want to create a spherical object, perhaps to cover it in watery waves as shown in Pictures 162 and 163.



Pictures 162+163

Amplitude

The value for “Amplitude” determines the strength of the movement of the points. Do not enter too large a value as the original shape of the object will then be lost.

Function

You can select from 13 different functions. Their curves are shown in the display window.

If you do not want any distortions in one direction of a plane, select function “1”.

Frequency

When using a function like the cosine function, you can specify with “Frequency” how often it will oscillate up and down. Normally this will be once. If you enter a frequency of 4, it will oscillate up and down exactly four times.

Phase

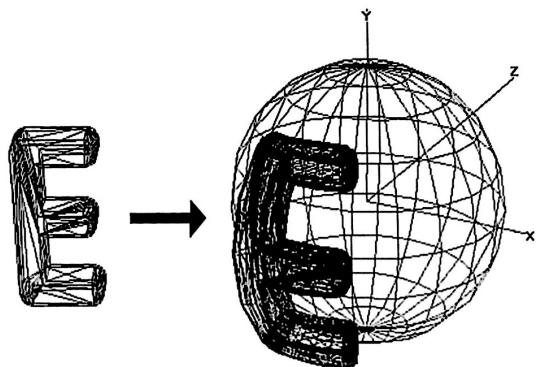
Normally the functions always start in the front left corner of the plane, i.e. at the point where the object's dimensions have the maximum negative co-ordinates. Using the phase location, however, you can move the functions freely in the direction of the function's operation. A phase of 50%, for example, makes the function start in the middle of the plane rather than on the left. It will, however, still operate towards the left. But now it will run through the t-values of -0.5 to +0.5, while with a phase setting of 0% it will run through the t-values of 0.0 to 1.0.

To help you calculate precisely what the effect of a particular function will be, we have listed here all the formulae used by Cinema4D to calculate the movements. A is the amplitude, f the frequency and P the phase of a function. The t parameter ranging from 0.0 to 1.0 indicates the position along one direction of the plane. V is the result of the function. The first function is multiplied with the second function and then again with the amplitude. The relevant point is then moved by the value resulting from this multiplication.

List of all functions

Constant	$V = 1.0$
Straight	$V = (t - P) * f$
Amount	$V = (t - P) * f $
Square	$V = ((t - P) * f)^2$
Cubic	$V = ((t - P) * f)^3$
Hyperbola1	$V = 1.0 / ((t - P) * f)$ With Hyperbola1, values greater than 1 are set to 1 and values smaller than -1 to -1.
Hyperbola2	$V = 1.0 / ((t - P) * f)^2$ With Hyperbola2, values greater than 1 are set to 1.
Cosine	$V = \cos(2\pi(t - P) * f)$
Wobble	$V = \sin(2\pi(t - P) * f) * \cos(2\pi * 10 * (t - P) * f)$
Reduction	$V = e^{-(t - P) * f} * \cos(2\pi * 10 * (t - P) * f)$
Root	$V = \sqrt{ (t - P) * f }$
Exponential 1	$V = e^{(t - P) * f}$
Exponential 2	$V = e^{-(t - P) * f}$
Exponential 3	$V = e^{ (t - P) * f }$
Sawtooth	The sawtooth function is difficult to represent in a formula. Like the other functions, its phase can be moved and it is dependent on the frequency entered.

4.9 Wrap



Picture 164

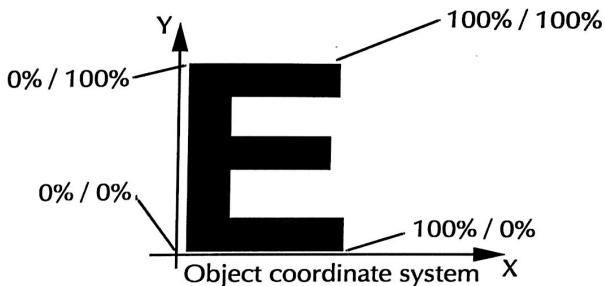
The dimensions are calculated along the X and Y axes of the Object Co-ordinate System.

This function is used to wrap (bend) the active object or active object group around a cylinder, a sphere or a path. In contrast to the “Arrange” function, which arranges several objects along a path or the thread of a screw, wrap merely moves, rotates and scales the individual objects without changing the individual points in the process, the “Wrap” function also changes the individual points of an object.

Cinema4D proceeds by first determining the dimensions of the object and the position of each point relative to these dimensions. It then calculates the new position on a sphere or cylinder from these dimensions.

Take, for example, the three-dimensional letter “E”. It lies on the XY plane of the World Co-ordinate System (Picture 164).

If you now select the “Wrap” function with the “Sphere” wrap mode, Cinema4D will calculate the X and Y position of each point relative to the Object Co-ordinate System (Picture 165). The top left corner of the letter, for example, has the position (0%, 100%), the bottom right corner the position (100%, 0%) and the top right corner the position (100%, 100%).



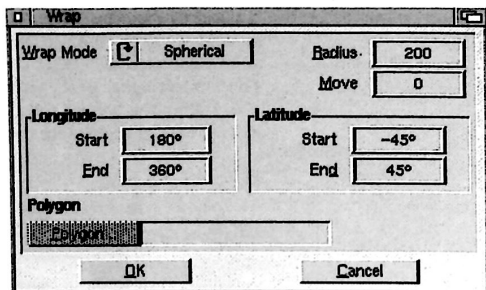
Picture 165

Next, Cinema4D recalculates the percentage values for the X and Y directions into angles, i.e. longitudes and latitudes on the sphere.

The result is a letter bent like the surface of a sphere.

You can wrap objects not only around spheres or cylinders, but also around polygons. This works in a fashion similar to the “Arrange” function, where several objects are positioned so that they follow the polygon’s curve path. “Wrap”, by contrast, relates to the individual points of the object.

Take a chain, for example. With “Arrange”, each link keeps its original shape and is merely repositioned. With “Wrap”, however, in addition to the repositioning, the shape of the links is adapted to the polygon’s curve.



Picture 166

Wrap mode

Here you specify whether the object is to be wrapped around a sphere, a cylinder or a polygon. If it is to be wrapped around a polygon, Cinema4D will proceed as with the “Arrange” function - but with individual points, not the object as a whole.

Radius

Enter the radius of the sphere or cylinder. Cinema4D always wraps objects so that the X axis of the Object Co-ordinate System forms the equator of the cylinder or sphere.

Longitude

The start and end angle determine how far the object will be wrapped around the cylinder or sphere in the horizontal direction. For example, a start angle of 0 degrees and an end angle of 180 degrees mean that the object is wrapped halfway around the sphere or cylinder, beginning with the X axis of the relevant co-ordinate system.

Latitude

You can only enter a start and end angle for the “Sphere” wrap mode, as these fields are disabled otherwise. In analogy to the longitude this is used to define how far the object is wrapped around the sphere in the vertical direction.

This function is suitable for objects such as the text “Cinema4D”, which are to be wrapped around a sphere. Please note, however, that a large object consisting of relatively few surfaces, can only be wrapped incompletely since many small surfaces are required for that. You can solve this by using the “Subdivide” function first in order to increase the number of surfaces.

Move

Here you can specify whether the points are to be moved in addition to being wrapped. To do this, enter the movement vector. Otherwise you should always enter the values (0,0,0) here.

A movement is overlaid over the wrapping. Thus, if you wrap a text string around a cylinder and enter a movement of 100 units in the Y direction at the same time, the text string will spiral upwards.

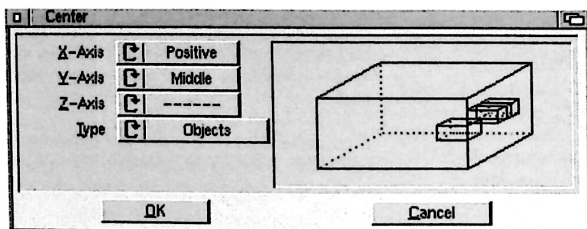
4.10 Centre

This function is similar to the functions bearing the same name in many word processors. In word processors, you can align the characters of multi-line text with the left or right margin or centre them in the middle so that each text line is positioned symmetrically in the centre of the page.

The “Centre” function in Cinema4D works in much the same way, except that instead of letters, objects can be centred in a three-dimensional space.

You can only select this function when an object group is active.

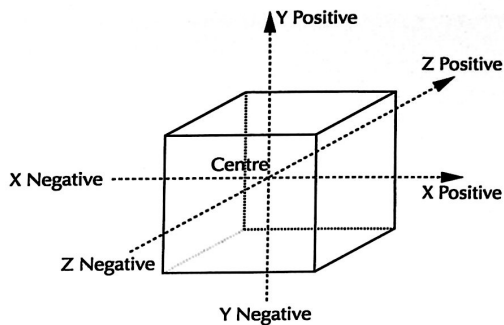
Cinema4D first determines the dimensions of the object group in the Object Co-ordinate System of the active object. You can visualise these dimensions as a three-dimensional block in space. The dimensions serve as reference points. You can now specify for each spatial direction of this block, whether the sub-objects and the active object will be centred along this axis - independently of the other axes - at the positive or negative end, or in the middle. You can also specify that the objects are not to be centred in a spatial direction at all.



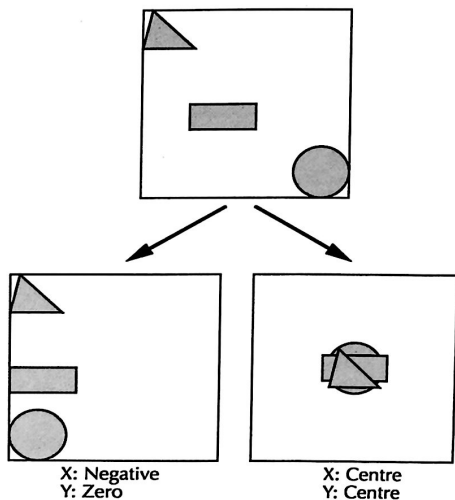
Picture 167

X axis, Y axis, Z axis

Here you can specify for each direction individually whether the objects are to be centred not at all (-), at the positive end (positive), the negative end (negative), or in the middle (middle) (Picture 168).



Picture 168



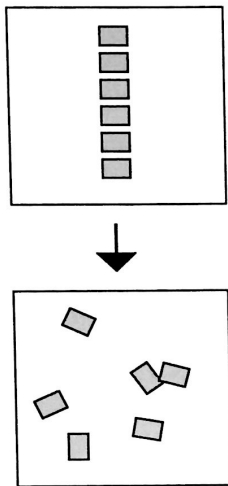
Picture 169

Picture 169 shows two examples of possible arrangements, in two dimensions for clarity.

Type

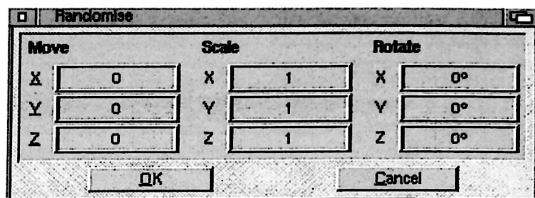
Here you select whether the objects or their axis systems only are to be centred.

4.11 Randomise



Picture 170

This function is used to position a larger number of objects randomly (Picture 170). This allows you to, for example, create a forest by having Cinema4D position the tree in a random fashion. If you also rotate the trees randomly around their vertical axis and change their dimensions, the forest will look particularly realistic. This function can save a lot of effort with large numbers of objects.



Picture 171

Move

Enter the maximum value by which an object can be moved. A value of (100,0,0), for example, means that the objects are moved by up to 100 units from their original position in the X direction of their own co-ordinate system, while the Y and Z positions remain unaffected.

Scale

Enter the maximum values by which an object can be scaled. A value of (3,1,1), for example, means that an object is enlarged in the X direction of its Object Co-ordinate System by a maximum factor of three, and reduced to a minimum of a third. Its Y and Z dimensions remain unaltered.

Please note that all values entered refer to the local Object Co-ordinate System of the relevant objects.

Rotate

Enter the three maximum values by which an object can be rotated. A value of (0,85,0) for example, means that each object can be rotated by up to 85 degrees around the Y axis of its Object Co-ordinate System. The rotation sequence is Y axis first, then X and Z axis.

5.1 Texture



5.1.1 Flat Texture

When you select this function, the texture will be projected flat onto the object. Alternatively, you can click on the “Wrap object” icon in the Texture Tools window.

The function is described in detail in Reference III.3.



5.1.2 Spherical Texture

When you select this function, the texture will be projected radially, i.e. in the shape of a sphere, onto the object. Alternatively, you can click on the “Wrap sphere” icon in the Texture Tools window.

The function is described in detail in Reference III.1.



5.1.3 Cylindrical Texture

When you select this option, the texture will be projected onto the object in the shape of a cylinder. Alternatively, you can click on the “Wrap cylinder” icon in the Texture Tools window.

This function is described in detail in Reference III.2.



5.1.4 Tile Texture

When you select this menu item, the tile texture of the active object is enabled or disabled. When the tile texture is active, the menu item is marked with a tick. You can also set the tile texture in the Texture Tools window.

This function is described in detail in Reference III.4.

5.1.6 Transfer to Sub-Objects

When you select this function, Cinema4D transfers the texture of the active object to all its sub-objects. You need to call this function whenever you want to assign a common material with a common texture to an object group.



5.1.7 Adopt Object Axes

This function rotates the texture axes so that they are parallel to the object axes.



5.1.8 Adopt World Axes

This function rotates the texture axes so that they are parallel to the axes of the global World Co-ordinate System.



5.1.9 Adapt Texture to Object

This function changes the position of the texture axes and the texture so that the texture covers the object fully. This function is explained in Reference III.7.



5.1.10 Orthogonal Texture

This function moves the texture so that it is positioned orthogonally (vertically) to the viewing direction. This is the camera plane in the “Perspective” and “3D” views, and the workspace in all others.



5.1.11 Flip Horizontally

This function flips the texture so that it is projected as a horizontal mirror image.



5.1.12 Flip Vertically

This function flips the texture so that it is upside down.

*Reference IV.
describes in detail
how to activate,
set and delete
points.*



5.2 Points

These functions are used to edit the points of objects. You can edit individual points as well as groups of points.

5.2.1 Snap to Grid

This function aligns one or more points with the Move grid. This function is explained in detail in Reference IV.3.



5.2.2 Align

This function is used to move all active points to a common plane. It is explained in detail in Reference IV.4.



5.2.3 Split

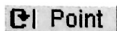
This function is used to create a new object from the active points, edges or faces. It is described in detail in Reference IV.2.



5.2.4 Magnet

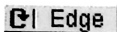
You can enable or disable the magnet by repeated selection of this function in the menu. Alternatively, you can select and de-select the “Magnet “ icon in the Point Tools window. If you hold down the SHIFT key when selecting this function, the “Magnet” window appears.

The “Magnet” function is explained in detail in Reference IV.1.



5.2.5 Points

To edit the points of the active object.



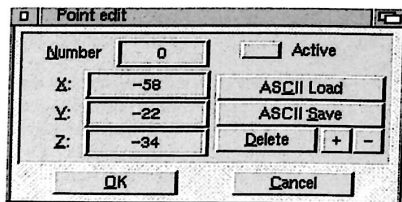
5.2.6 Edges

To edit the edges of the active object.

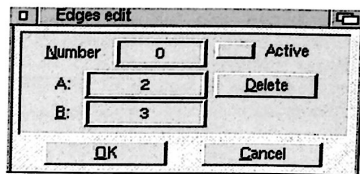
To edit the faces of the active object.

5.2.8 Edit Elements

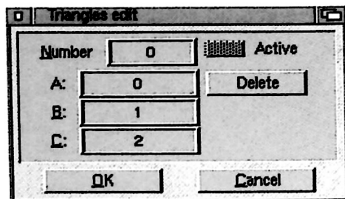
This function allows you to edit the points, edges or triangles in an object separately and numerically. You choose between the three object elements in the Point Tools window using the “Elements” icon, or in the “Extra/Points” menu. “Faces” means “Triangles” here. Squares cannot be edited or created numerically as squares need to be level and this is not normally guaranteed with numerical input. However, to edit a torus, for example, you can use the “Triangulate” function in the “Extra/Structure” menu to convert squares to triangles. These triangles can then be edited.



Picture 172



Picture 173



Picture 174

When you select this function, one of the three windows shown here is opened. They are explained as one because the three windows work in identical fashion.

Number

Here you enter the number of the element to be edited, starting with number 0. If the number exists, the corresponding data will be shown. If not, a new element will be created.

For example: You are editing an object with 1000 points. To edit point 536, enter 536 as the value for "Number". As soon as you quit the input field, the point's values will be shown in the other fields. To create a new point, simply enter any value greater than 2000. Cinema4D will then create a new point with the number 1000 (0-999 already exist).

X, Y, Z

Here you edit the co-ordinates of a point.

A, B

Here you set the point numbers of an edge.

A, B, C

Here you set the point numbers of a triangle.

Delete

Deletes the selected element.

Active

Here you set the current element as selected. Changes take immediate effect in the workspace.

Load ASCII

Cinema4D is capable of reading the points data of other programs. The data must be available as an ASCII file in the following format:

```
<Number of points>

<X1 co-ordinate> <Y1 co-ordinate> <Z1 co-ordinate>

<X2 co-ordinate> <Y2 co-ordinate> <Z2 co-ordinate>

<X3 co-ordinate> <Y3 co-ordinate> <Z3 co-ordinate>

etc.
```

The following example gives a polygon with three points:

```
3

100.1      47.0   14.0

200.0      89.3   14.0

300.0      33.0   14.2
```

The three-dimensional co-ordinates of a point must be separated by a space. Each line must only contain the co-ordinates of a single point. The lines must be separated by a “Return”. The text file must not use units such as “mm” or “cm”.

When you click on “Load ASCII”, the file requester window appears for you to enter the pathname of the points file. The new points are added to the existing points and appended at the end.

Save ASCII

Cinema4D can also export the points data to other programs. The points are output in the format described above.

When you click on this function the file requester window appears for you to enter the pathname of the file to be saved. All points, included the de-selected ones, are saved.

-

This function is used to decrease the point number of a point. The point swaps with the previous point.

Select the required point and click on “-” until the point has reached the required position.

This function is particularly useful to change the sequence of points in polygons.

+

This function is used to increase the point number of a point. The point swaps with the following point.

Select the required point and click on “+” until the point has reached the required position.

This function is particularly useful to change the sequence of points in polygons.

5.2.9 Tolerance

This option is used to specify whether, when selecting several edges or faces using <CTRL>, only those edges and faces which are located completely within the frame are to be selected, or whether those only partially located inside the frame should also be included. When Tolerance is enabled, all those elements which have at least one point inside the frame will be selected.

The section on the “Points Tool window” (cf. Reference IV.) describes in detail the selection, setting or deletion of polygon points.

Polygon parameters such as the interpolation type and name can be set in the “Information” window on the “Parameters” page.

5.3 Polygon

Here you can find a number of interesting functions which can simplify or accelerate your work with polygons. For example, a push of the button can insert an arc or a loop into a polygon.



5.3.1 Round

This function is used to replace several points with several interpolated points. It is described in detail in Reference IV.8.



5.3.2 Arc

This function replace three selected, adjacent points with an arc. The function is described in detail in Reference IV.7.



5.3.3 Helix

This function is used to insert a helix into a polygon. The function is described in detail in Reference IV.6.



5.3.4 Join

This function is used to insert a polygon into another polygon. The function is described in detail in Reference IV.5.

5.3.5 Reverse

The first point of a polygon which is entered gets the number 0. Each further point is assigned the following numbers. This function reverses the sequence of the points.

5.3.6 Forward

This function can be used to increase the numbers of all points by one. Point 0 becomes point 1, point 1 becomes point 2, and so on. The last point becomes point 0.

5.3.7 Back

This function is used to decrease the numbers of all points by one. Point 2 becomes point 1, point 1 becomes point 0 and so on. Point 0 becomes the last point.

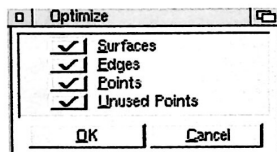
5.4 Structure

Here you find all the functions used to, for example, eliminate defective faces or subdivide squares into triangles.

5.4.1 Optimise

When you have put together an object from many individual triangles and squares, perhaps using the “Merge” function, then there are often several points, edges and faces which exist twice or more. This costs valuable storage space and processor time. Cinema4D therefore provides the “Optimise” function to eliminate unwanted duplicate elements. The appearance of the object normally remains unaffected.

Take care with objects where duplicate edges exist on purpose in some parts. This can be intended in order to, for example, maintain hard edges despite an active “Smoothing” option.



Picture 175

Faces

This option is used to specify whether one-dimensional faces are to be removed.

Edges

This option is used to specify whether multiple edges are to be removed.

Points

This option is used to specify whether multiple points are to be removed.

Unused Points

This option is used to specify whether unused points are to be removed.

5.4.2 Merge

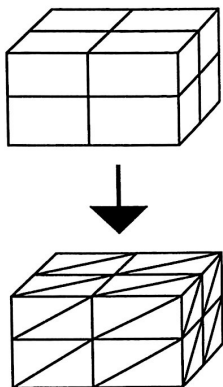
In addition to the ability to combine several different objects into one object group, Cinema4D can also combine several objects into a single new object (“merge” them into one). If, for example, you have created a handle and a can, you can combine these two objects into a new object (a watering can) which contain the faces, edges and points of both objects.

You can only select this function when an object group is active. Cinema4D will then merge all points, faces and edges into one new object with the name and the parameters of the old active object.

“Merge” is not a Boolean operation, but merely combines several objects into a new object.

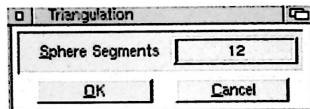
You should only use this function when you are completely certain that the objects really belong together, since you will never be able to separate them again (at least not without a major effort). Also, all parameters of the sub-objects, such as animation sequences, are lost with this function.

5.4.3 Triangulate



Picture 177

Triangulate converts all squares in an object into triangles (Picture 177). If the object is a perfect sphere, the sphere will be converted into triangles and squares. The number of subdivisions can be specified if this function is called with the SHIFT key pressed.



Picture 176

Triangulation increases the amount of memory required by an object, depending on the number of squares it contains. The object will also be displayed a little more slowly and will require more time when rendered.

5.4.4 Repair

This function tests all squares in an object for being level. Objects that have not been converted with MagicLink can sometimes have squares with corner points that are not on the same plane. When rendering pictures, Cinema4D always assumes that squares are level, however, and errors occur when this is not the case.

You could, of course, only use triangles all the time. But triangles should only be used when strictly necessary as they are slower to render than squares.

This function may sometimes require considerable processing time.

5.4.5 Randomised Edges

Cinema4D employs an intelligent technology: the edges of an object are always drawn in randomised sequence so that an object is displayed gradually as shown in Picture 178. You therefore get an early impression of the object and can continue with your work even before the object has been fully drawn.

All objects created by Cinema4D have randomised edges. Objects that have not been converted with MagicLink, however, may lack this attribute. You should then disable "Randomised edges".



5.4.6 Align

This function is used to align the normal vectors of an object with each other. All primitives created with Cinema4D already have aligned normal vectors. This function is therefore primarily for triangles which you have created yourself and which are not properly aligned.

When rendering smoothened objects, Cinema4D always assumes that the normal vectors are aligned with each other. If this is not the case, there can be anomalies in the rendering of shadows. (cf. Basics 17.).

5.5 Camera

5.5.1 Camera

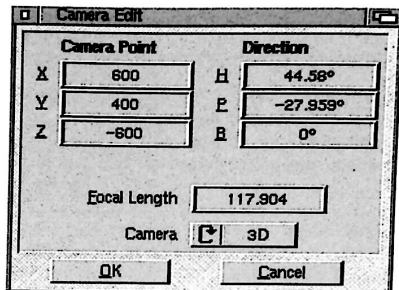
This is to set the 3D and “Perspective” camera. It is not necessary to have selected the appropriate camera.

Camera Point

Enter the camera position here.

Direction

Enter the camera view here.



Picture 179

Focal Length

Enter the camera focus here (cf. Basics 10.)

Camera

Select which of the two cameras is to be edited.

5.5.2 Camera Forward

cf. previous function.

5.5.3 Camera Back

cf. previous function.

5.5.4 3D to Perspective

Copies the 3D view camera to the Perspective view.

5.5.4 Perspective to 3D

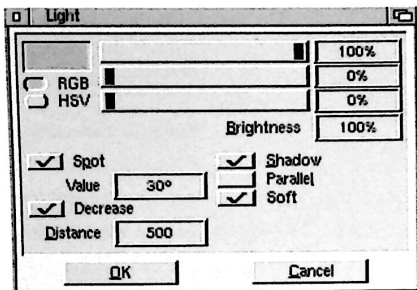
Copies the Perspective view camera to the 3D view.

5.6 Light/Polygon

This function is used to edit the active light source or the active polygon. Depending on the object, the “Light” or the “Polygon” window is opened.

5.6.1 Light Window

The sliders and the adjacent text input fields are used to define the colour of the light source.



Picture 180

Brightness

Irrespective of the colour of the light source you can define how bright the light source is to be. Maximum brightness is 400% and can be dimmed smoothly. You can therefore simulate the light of a candle as well as bright sunlight. The default value is 100%. Larger values are especially useful when the light source is losing intensity.

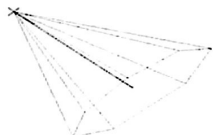
Spot

Realistic scenes sometimes require a light source that, like a spotlight, casts light on one area of a room only (Picture 185). You can do this with “Spot”. “Value” means the beam angle when the light is not parallel, and the radius of the area covered when it is parallel.

With divergent light, the rays run in a cone with its tip at the light source position (Pictures 181 and 182). The rotation axis of the cone points in the direction of the Z axis of the Object Co-ordinate System. All objects outside this cone are not lit by the light source.

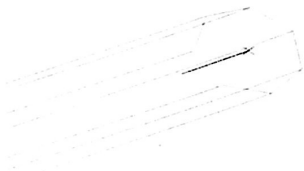


Picture 181

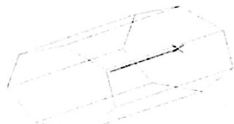


Picture 182

With parallel light, all rays run parallel to the Z axis of the Object Co-ordinate System within a cylinder (Pictures 183 and 184). The radius of this cylinder is defined by the “Value” parameter.



Picture 183

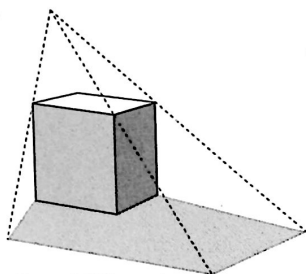


Picture 184

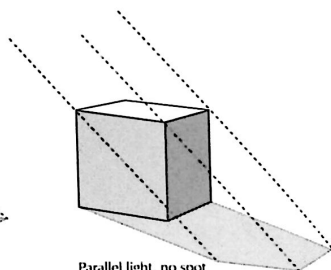
Value

With non-parallel light, enter here the opening angle of the light cone in degrees. An angle of 30 degrees means that the light rays deviate a maximum of ± 15 degrees from the direction of the Z axis of the light source.

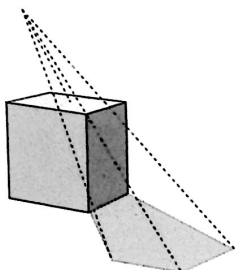
With parallel light, you enter the radius of the disc-shaped area covered by the light.



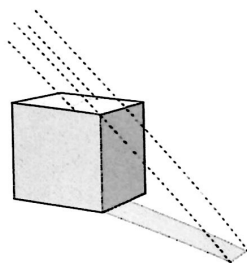
Non-parallel light, no spot



Parallel light, no spot



Non-parallel light, spot, 15 degree angle



Parallel light, spot, radius 50

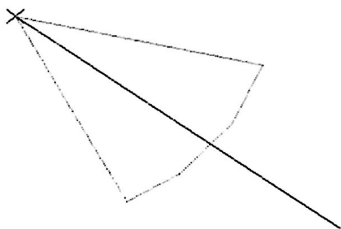
Picture 185

Decrease

Here you can enter whether or not the light intensity is to decrease in a linear relationship with the distance covered, or not. When you select this option, the light rays will lose intensity with increasing distance from the light source. The strength of the decrease is defined under "Distance".

Distance

Here you enter the distance at which the light source loses all its intensity (Picture 186).



Picture 186

If, for example, you enter a value of 500 for "Distance", a light ray with an original intensity of 100% will only retain an intensity of 20% at a distance of 400 units, and will expire completely after a further 100 units.

Shadow

Here you specify whether or not the light source will cast shadows when rendered with the Ray-Tracer.

As a general rule it is a good idea to light the entire scene with a distant light source which casts no shadow. Objects in the foreground, however, should be lit by a shadow-casting light source in order to enhance the perceived depth of the objects.

Please note that transparent objects (e.g. colour slides) can only cast a shadow on another object if the “Shadow” option has been activated for the light source as well as for the object material and the Ray-Tracer.

Parallel

Here you specify whether or not the light from the active object is to be parallel or point-shaped. With a parallel light source, the position of the light source is irrelevant. The entire 3D space is lit in the direction of the Z axis. Parallel light sources can, for instance, be used to simulate sunlight or a laser.

Soft

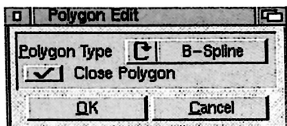
Select this option if you do not want a spotlight source to generate an evenly bright cone. The intensity will then decrease from 100% in the centre of the cone towards the outside. At the edge of the cone, the intensity will fall to 0%.

Caution: in addition to the loss of intensity described here, it will also decrease with the distance from the light source if the “Decrease” option is enabled.

List of light source combinations

Type	Spot	Parallel	Decrease	Soft
Point-shaped light source beaming in all directions	no	no	no	no
Point-shaped light source beaming in restricted direction	yes	no	no	no
Point-shaped light source beaming in restricted direction and with decreasing intensity with distance from X axis of light source	yes	no	no	yes
Point-shaped light source beaming in all directions with intensity decreasing with distance from light source	no	no	yes	no
Point-shaped light source beaming in restricted direction with intensity decreasing with distance from light source	yes	no	yes	no
Point-shaped light source beaming in restricted direction with intensity decreasing with distance from light source and distance from Z axis of light source	yes	no	yes	yes
Parallel light source lighting entire space in Z direction	no	yes	no	no
Parallel light source lighting entire space in Z direction, with intensity decreasing with distance from light source	no	yes	yes	no
Parallel light source lighting cylinder space in Z direction	yes	yes	no	no
Parallel light source lighting cylinder space in Z direction, with intensity decreasing with distance from light source	yes	yes	yes	no
Parallel light source lighting cylinder space in Z direction, with intensity decreasing with distance from cylinder axis	yes	yes	no	yes
Parallel light source lighting cylinder space in Z direction, with intensity decreasing with distance from light source and distance from the cylinder axis	yes	yes	yes	yes

5.6.2 Polygon Window



Picture 187

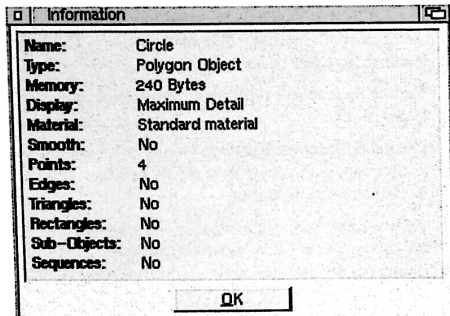
Polygon Type

Select from the interpolation types “Linear”, “Cubic”, “Akima” and “B-Spline” here (cf. Basics 13.).

Close Polygon

Specify if the start and end points of the polygons are to be linked.

5.7 Information



Picture 188

This function gives you important information about the active object. It shows the name of the object, the object type, memory usage, editor display, material used, smoothing, number of points, number of edges, number of triangles, number of squares and number of sub-objects.

5.8 Align to

“Align to” is used to turn the object so that it points to the direction of another object with its Z axis. This function is very useful especially if you want the camera or a light source to point at a particular object.

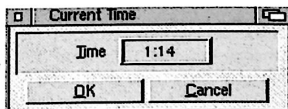
6. Keyframe

The functions in this menu can also be found in the “Time” window and are therefore explained only briefly here.

6.1 Record

This function - depending on the active Record options (cf. Reference V.9.7.) - creates sequences and keys for the active object. If the “Sub-object” option has been activated in the “Time” window, all the sub-objects of the active object are also given sequences and keys.

6.2 Current Time



Picture 189

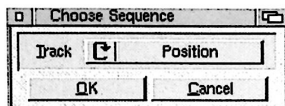
This function is used to define the current time when the scene will be displayed in the document window (cf. Reference V.9.7.). You can only enter values which do not exceed the total length of the animation. Alternatively, you can use the slider or the arrow symbols in the “Time” window.

6.3 Delete Key

This function is used to delete one or more keys located at the current time. Only keys whose tracks are active in the “Time” window will be deleted.

6.4 Delete Sequence

This function is used to delete the sequence of one track. The sequence deleted is the one containing the current time.



Picture 190

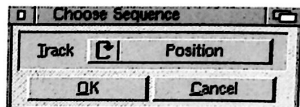
A window appears for you to select the track (position, size, direction, material, texture or texture axes) from which the sequence is to be deleted.

6.5 Delete Sequences

This function deletes all sequences on the position, size, direction, material, texture and texture axes tracks which include the current time.

6.6 Edit Key

This function is used to edit the key of a sequence. The key must already be present at the current time to be able to do this.

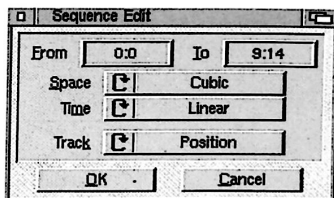


Picture 191

First a window appears for you to select the track (position, size, direction, material, texture and texture axes) in which the sequence with the key can be found. Then another window appears with the data of the key.

6.7 Edit Sequence

Here you can change the parameters of the sequence including the current time.



Picture 192

From, To

Start and end time of the sequence. You can freely set the times as long as no keys are cut off. The start time must always be greater than or equal to the time of the first key, while the end time must be smaller than or equal to the time of the last key.

Space

Select the interpolation type for the spatial interpolation, i.e. the interpolation of the data.

When using the "Cubic" and "Akima" interpolation types, values can sometimes become a little exaggerated. You can avoid this by setting more keys.

You can only change the "Time" field for the tracks "Position", "Size" and "Direction", otherwise it is disabled because a time interpolation is not necessary or sensible for the other parameters.

"Linear" is used to define very abrupt and jumpy movements, while "Cubic" and "Akima" result in softer and more rounded animations. If a movement needs to be especially soft, select the "B-Spline". "B-Spline" interpolation is particularly soft because it does not run through control points.

A special type of animation is "Jump". With this type, the object jumps from key to key and the intermediate positions are not used. The time spent by the object with a key corresponds to the time that would be needed by the object to get from key to key if linear interpolation was used.

Time

Select the interpolation type for the time here.

A movement which is of constant speed between two keys can be achieved with "Linear". If the movement is to feature soft accelerations and decelerations, choose either "Akima" or "Cubic".

Track

Here you select from which track (position, size, direction, material, texture or texture axes) you want to edit the sequence.

If there is no sequence for a track at the current time, the input fields will be disabled.

6.8 Linearise

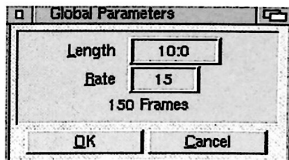
Recording keys at different times and locations will generally produce uneven temporal and spatial distances between the individual keys, resulting in uneven movements with accelerations. If this is not desired, you can use "Linearise" to eliminate the accelerations. Movements will then take place at a constant speed.

“Linearise” moves the keys of the sequences Position, Size and Direction (provided the corresponding tracks have been selected in the “Time” window) so that the values are interpolated at constant speed (cf. Reference V.8.9.). The sequences changed are those that include the current time.

Linearise will not work if the keys are too close together or the rate has been set too low. It is then impossible to move the keys in time.

6.9 Global Parameters

The “Global Parameters” function is used to set the length and rate of an animation.



Picture 193

Length

Enter the length of the animation here. You can always extend the animation. If you shorten the animation, existing keys and sequences may be cut off. In that case there will be a safety alert.

Rate

Here you define how many pictures Cinema4D is to render for one second of animation. If, for example, the entire animation lasts for 100 seconds and you have 25 pictures per second rendered, the result is 2,500 pictures. Instead, you can have only 10 pictures per second rendered. The result then is 1,000 pictures.

The rate discussed here is nothing to do with the playback rate of the animation and can be set entirely differently. Setting both rates to the same value, however, can make things clearer.

Cinema4D can only play back pictures with two colours.

6.10 Play

This function is used to play back any number of individual pictures in real time from the hard disk.

If, for example, you have rendered a fast preview version of your animation using “Black & White Wireframe”, you can now inspect this immediately.

If you have not specified a path so far or have called the function with the SHIFT key held down, the file requester window will appear first.

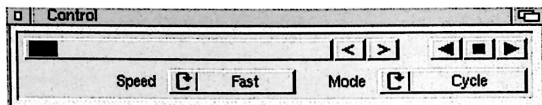
Enter the pathname of any picture of the animation. It does not matter whether you enter the name only (e.g. “Test”) or the name with a picture number (e.g. “Test.0043”).

Cinema4D searches the specified directory automatically for all pictures with the specified name, beginning with picture number 0000 and finishing with the highest number.

Cinema4D now loads as many pictures into the computer’s memory as possible before it is full. The remaining pictures will be loaded from the hard disk when necessary.

Then Cinema4D opens a window of the same size as the animation and displays the first picture of the animation. If the animation is larger than the existing screen resolution, the animation is cropped at the margins.

In addition, the “Control” window appears which can be used just like a video recorder.

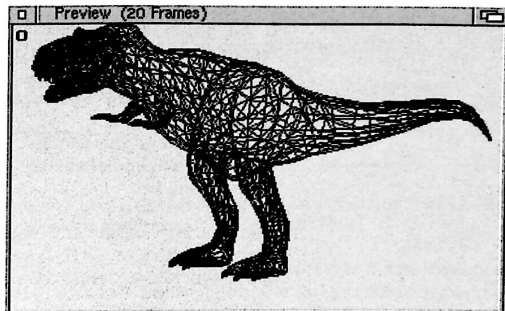


Picture 194

The slider is used to move immediately to particular pictures. The arrow symbols to the right of the slider are used to move forward or backward one picture at a time.

The solid arrow symbols are used to start playback of the animation. Depending on the symbol selected, the animation will be played forward or backward.

If the main memory is not sufficient to load all pictures of an animation, the remaining pictures are loaded from the hard disk. Depending on the size of the pictures and the speed of the hard disk, the playback speed can be slowed down by this.



Picture 195

The “Stop” symbol between the two solid arrows is used to stop the animation.

“Speed” is used to set the playback speed of the animation. You can choose between “Slow”, “Medium”, “Fast” and “Maximum”. With “Slow”, “Medium” and “Fast” the animation will be played picture by picture, with longer or shorter pauses between them. “Fast” utilises the full speed of your computer and your hard drive. If this speed is insufficient, you can select “Maximum”. “Maximum” only displays every fifth picture.

To speed things up, select “Maximum”, reduce the resolution of the rendered pictures or save the pictures in uncompressed format.

7. Time Line

Here you find all the functions for the Cinema4D “Time Line”.

7.1 Select Range

If you have already selected an element, you can use this function to redefine the start and end time of the element. Only the marked region will then be used for the “Cut”, “Copy”, “Paste” and “Delete” operation as well as all other functions.

When you select this function, Cinema4D prompts you for the start and end time of the region. You can use mouse clicks to define these.

You can also define the region manually if you select the function with the SHIFT key held down. An input window appears for you to define the start and end times.

If a block or hierarchy block is active, the settings are copied to all sequences of the (hierarchy) block.

7.2 Edit Element

This function is used to edit an active element.

If a key is active, an input window appears for you to change the time and the data of the key (cf. Reference V.6.6.).

If a sequence is active, a window appears for you to enter the start and end point of the sequence. In addition, you can also define the interpolation type (cf. Reference V.6.7.). Since special effects do not contain keys and the data are contained directly in the sequences, the relevant effect window will appear immediately if a special effect sequence is active.

7.3 Move Element

This function is used to move a sequence in time. You are prompted to click on the new start time with the mouse.

If you select this function with the **SHIFT** key held down, this value can also be entered numerically.

7.4 Scale Element

*Individual keys
cannot be scaled.*

This function is used to lengthen or shorten an element. You are prompted to click on the new start and end time with the mouse. If you select this function with the **SHIFT** key held down, these values can also be entered numerically.

The keys contained in the element are also scaled in time.

7.5 Join Element

Here you can join together all the sequences contained in the selected element and located on the same track.

Joining two previously separate sequences into a new sequence eliminates (with soft interpolation) the abrupt transitions at the former point of separation.

7.6 Split Element

Here you can separate all the sequences contained in the selected element at a particular point in time. Cinema4D will prompt you for the separation time which must be between the start and end time of the element.

If, for example, a sequence runs from Picture 0 to Picture 99 and 20 is entered as the separation point, Cinema4D will create two new sequences from Picture 0 to Picture 19 and from Picture 20 to Picture 99.

Cinema4D automatically inserts new keys at the separation point if the separation point lies between two keys.

When sequences are loaded they are adapted to the current rate. If, for example, the sequences were saved from a document with 18 pictures per second and are now to be inserted into a document with 24 pictures per second, all points in time are scaled by a factor of 24/18.

Cinema4D only saves individual sequences, tracks or blocks, but not keys or hierarchy blocks.

This function can also be called with the SHIFT key held down. A window is then opened for you to enter the separation point numerically.

7.7 Load Element

Loads a previously saved element from the hard disk.

First the file requester window appears, for you to enter the pathname of the element. Then you are prompted to define the object and the time at which the element is to be inserted. To do this, position the mouse at the level of the required object and click on the required insertion time.

7.8 Save Element as

Saves an active element. The file requester window appears for you to enter the pathname under which the element will be saved on the hard disk.

This function can be used to save entire blocks with all their tracks at once. Hence you can create entire libraries of interesting animations and sequences which you can often re-use in other animations.

7.9 Fit Element

When creating a keyframe animation, the keys of a sequence frequently do not begin at the start time of the sequence, nor do they finish at the end time of the sequence. They are somewhere in between. This function can be used to change the sequences of the active element so that beginning and end coincide with the time of the first and last key. This is in the interest of clarity and can increase the interval between two sequences - perhaps for a new sequence.

7.10 Linearise Element

Linearises the active element (cf. Reference V.6.8.).

8. Time Control

Here you find all the functions of Cinema4D's "Time Control" window.

8.1 Distance-Time

Displays the distance in relation to the time.

8.2 Speed-Time

Displays the speed in relation to the time.

8.3 Position

Displays the keys of the "Position" sequence, which includes the current time, in a diagram.

8.4 Size

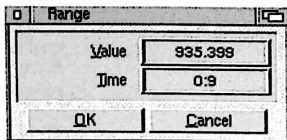
Displays the keys of the "Size" sequence, which includes the current time, in a diagram.

8.5 Direction

Displays the keys of the "Direction" sequence, which includes the current time, in a diagram.

8.6 Range

Here you enter the size of the section visible in the “Time control” window.



Picture 196

If, for example, you enter a value of 10 seconds for the time axis, the horizontally visible section is 10 seconds.

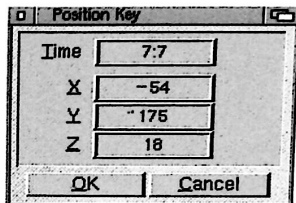
Much the same applies to the value axis where you can also enter any value. A value of 100, for example, means that a section of 100 units is visible. Depending on the sequence and option, the unit corresponds to metres, metres per second, angle etc.

8.7 Overview

This function brings the complete curve of the visible section into view.

8.8 Edit key

Opens a window from which you can select the key to edit.



Picture 197

8.9 Linearise

Recording keys at different times and locations will generally produce uneven temporal and spatial distances between the individual keys, resulting in uneven movements with accelerations. If this is not desired, you can use “Linearise” to eliminate the accelerations. Movements will then take place at a constant speed.

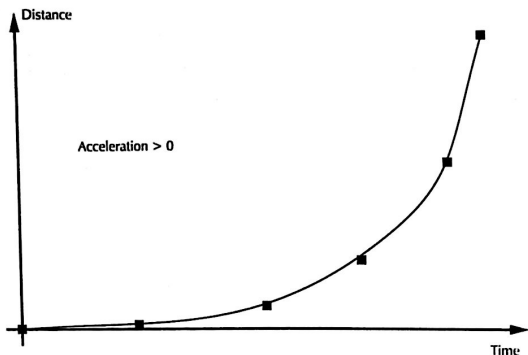
“Linearise” moves the keys so that the values are interpolated at constant speed. The sequences changed are those that include the current time.

Linearise will not work if the keys are too close together or the rate has been set too low. It is then impossible to move the keys in time.

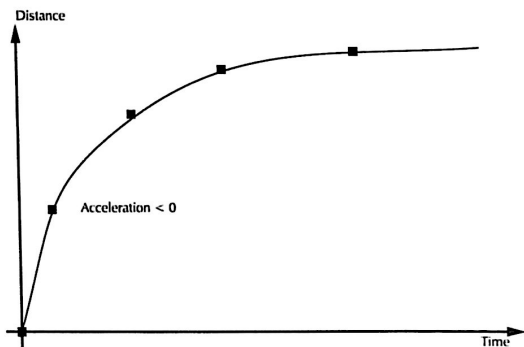
If you switch the curve display from “Distance-Time” to “Speed-Time”, you can see that the speed is even as a result of linearisation.

8.10 Acceleration

For realistic animations, the ability to accelerate (Picture 198) and slow down (Picture 199) objects is essential. Cinema4D offers an easy means of entering this with this function.



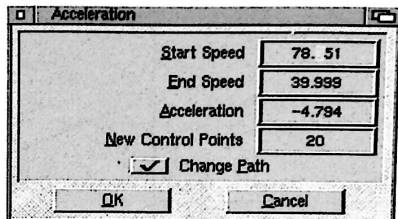
Picture 198



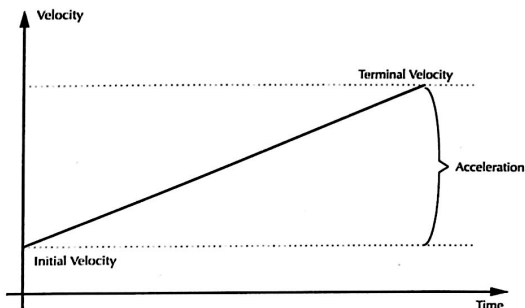
Picture 199

Start Speed

Here you enter the speed value at which the object is to start the sequence, in length or angle units per second (Picture 201). The values that can be entered here are limited at the top by the length of the arc and the duration of the sequence.



Picture 200



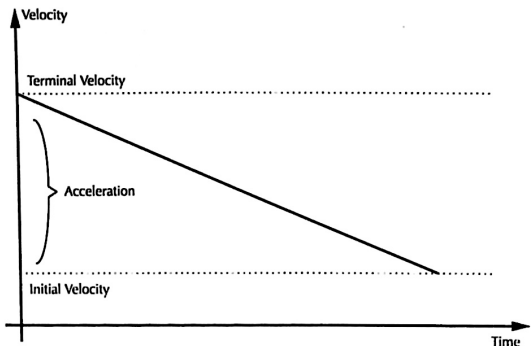
Picture 201

Please note that the start and end speeds, as well as the acceleration, are dependent on each other. A change in one value will not necessarily change the two others.

A start speed higher than the end speed results in negative acceleration (deceleration).

End Speed

Enter here the speed value which the object is to reach at the end of the sequence in length or angle units per second (Picture 202). The values that can be entered here are limited at the top by the length of the arc and the duration of the sequence.



Picture 202

If you enter the number 0, no new keys will be added.

Acceleration

Enter here the acceleration of the object in length or angle units per second. The values that can be entered here are limited at the top by the length of the arc and the duration of the sequence.

New Control Points

To move the existing keys so that they make up the defined acceleration curve, you can use this function to insert additional keys in order to achieve a better curvature. The insertion of additional keys is recommended in particular when only a small number of keys (less than four) are present.

If too few keys are present or the time resolution does not permit the insertion of new keys, the acceleration may turn out to be quite irregular.

$$s = v_a \cdot t + \frac{a \cdot t^2}{2}$$

$$v_e = v_a + a \cdot t$$

The keys of a sequence define the arc length s of the interpolation path. The start speed v_a , the end speed v_e , the duration of a sequence t and the acceleration a are related to each other by the following formula:

9. Window

In addition to the Main Toolbar and the document windows, Cinema4D offers a number of other windows and toolbars.

9.1 Information

The “Display” field on the “Object” page is for changing the settings for an individual object. If you want to change the settings for all objects simultaneously, you can do that by using the “Display” icon in the Main Toolbar (cf. Reference I.13.).

This window is just about indispensable for working with Cinema4D. You should only close it if you really have no free space at all left in your workspace.

This window can display all the most important parameters and data. These are grouped together on different pages. You use the “Info” field to select which of the pages to display. It is advisable, of course, to show the currently relevant groups: when editing an object, you should select the “Object” page, and when animating objects the “Animation” page is very helpful.

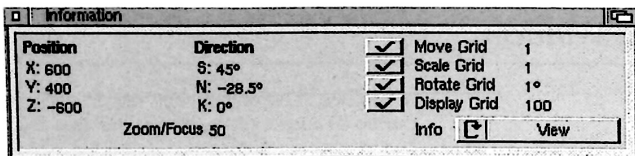
The window is not just useful to show the parameters. You can also change many values. To do this, simply click on the relevant field and change the numerical value using the keyboard. As soon as you press the <RETURN> key, the new value is accepted. Since the window is non-modal, you will be able to see the result instantly in the other windows.

A particularly useful aid is the integrated *parser*. This enables you to use mathematical expressions and formulae when entering values (cf. Basic 8.).

View Page

Here you see different things depending on the view:

- In the two-dimensional “XY”, “XZ”, “ZY” and “4T” views, the position of the document centre is always shown. The direction, by contrast, is disabled. The field “Zoom/Focus” is used to set the enlargement factor of the workspace.

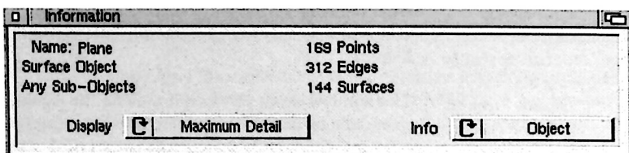


Picture 203

- In the three-dimensional “3D” and “P” views, the position, direction and focus of the camera are shown.

The values for the Move grid, the Scale grid, the Rotation grid and the Display Grid are always shown (cf. Basics 7.).

Object Page



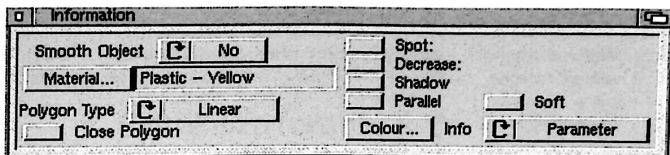
Picture 205

This page shows the name of the active object, the object type (e.g. polygon, light, sphere), the number of sub-objects, the number of points, edges and faces, and the display mode of the active object.

You can change the name of the object by direct input.

Under “Display” you can select between “Maximum Detail”, “Bounding Box”, “High Detail”, “Medium Detail”, “Low Detail” and “Invisible”. These option are explained under Reference I.13.

Parameters Page



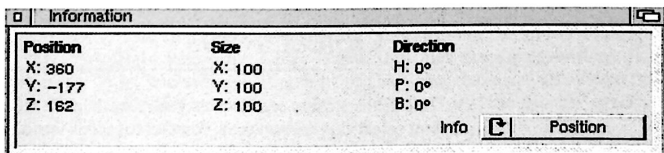
Picture 205

Here you find all the object-specific parameters. The two fields in the top left apply to bodies, the two fields below them to polygons and the remaining fields to light sources. Depending on the active object type, parts of the “Parameters” page are disabled.

The individual fields on this page have already been discussed elsewhere, so only the cross references will be listed here:

- “Smooth object”, cf. Basic 17.
- “Material”, cf. Basics 16.
- “Polygon type” and “Close polygon”, cf. Basics 13.
- “Spot”, “Decrease”, “Shadow”, “Parallel”, “Soft” and “Colour”, cf. Reference V.5.5.2.

Position



Picture 206

Cinema4D is very economical with computer resources.

However, if you are still running out of memory, close all other applications and perhaps also switch off the workbench. cf. Reference V.1.7.1.

Here the position of various elements is shown. If you are in “Edit view”, “Edit object” or “Edit object axes”, the position of the object axes is shown. If you are in “Edit points”, the position of the points is shown. The same applies to “Edit texture”, where the texture is shown. Finally there is “Edit texture axes”. Here the values of the texture axes are displayed.

9.2 Memory Display

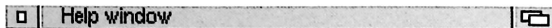
When this option is selected, a small window appears in screen to continuously display the remaining free memory. This is particularly useful for computers with limited RAM to ensure that you do not run out of memory.



Picture 207

9.3 Help

You will come to appreciate this function if you are still a beginner. It opens a wide but thin window that can be placed anywhere like the free memory display.



Picture 207

Whenever the mouse pointer moves over an icon in one of the icon bars, a brief explanation of the icon is now displayed.

9.4 Object Tools

The Object tools window is described in Reference II. When you select this menu item, the Object tools window is opened or closed.

9.5 Texture Tools

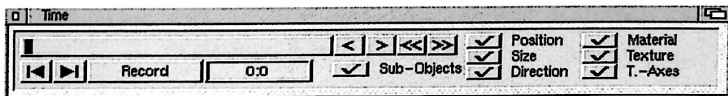
The Texture tools window is described in Reference III. When you select this menu item, the Texture tools window is opened or closed.

9.6 Point Tools

The Point tools window is described in Reference IV. When you select this menu item, the Point tools window is opened or closed.

9.7 Time

The “Time” window offers quick and easy animation input using the keyframe method.



Picture 208

First, a point in time is defined, the “Current time”. The object to be animated will be placed in a certain position at that time and “fixed” there with the “Record” function. When you have done this for two or more times, Cinema4D is able to calculate the intermediate pictures automatically.

The current time can be set quickly using the slider. The input field below the slider always indicates the corresponding time. In addition, to the right of the slider there are arrow symbols which you can use to increase or decrease the time by exactly 1 picture, or 1 second.

The time can also be entered manually into the input field. Depending on the editor setting (cf. Reference V.1.7.1.), the numerical input is interpreted as units of seconds or pictures. You can always, however, opt to use the extended notation (cf. Basics 8.) or to mark the numerical value with a “F” which signifies a picture number.

Position, Size, Direction, Material, Texture, T-axes

These recording options are used to define which attributes are to be stored in the keys when “Record” is selected.

If, for example, only “Position” is active, then only position keys will be created. The object may have been rotated in various directions at various times, but this information is not stored. The object will then change its position but remain in the same orientation as no direction keys are available.

Option	Key
Position	X, Y and Z value of the object origin
Size	X, Y and Z value of the object axis length
Direction	H, P, and B angle of the object
Material	Name of material
Texture	The texture offset (X, Y) and the texture length (X, Y)
T-axes	Origin (X, Y, Z), Size (X, Y, Z) and direction (H, P, B) of the texture axes.

The data of the keys can be manually edited with the “Edit key” function (cf. Reference V.6.12.).

Sub-Objects

Use this option primarily for hierarchy animations, for example the animation of a figure.

This option is used to make Cinema4D create keys during recording not only for the active object but also its sub-objects.

When a figure is animated, for example, this will be done by storing the positions, sizes, directions etc. of all sub-objects at the current time.

If, however, you are only animating individual objects - a spaceship, for example - then you should disable this option to avoid creating unnecessary keys for the non-moving sub-objects. Not only does this require additional storage space, but it also slows down screen redraws and the rendering of the animation.

Record

This is probably the most important function in keyframe animation. It fixes one or more attributes of the active object at a particular time.

If the object does not have any animation data so far, then sequences will be created. Depending on the active options, this is one sequence each for position, size, direction, material, texture and texture axes. The sequences are created in such a way that they have the maximum length (provided no other sequences exist as yet between 0 seconds and the end of the animation).

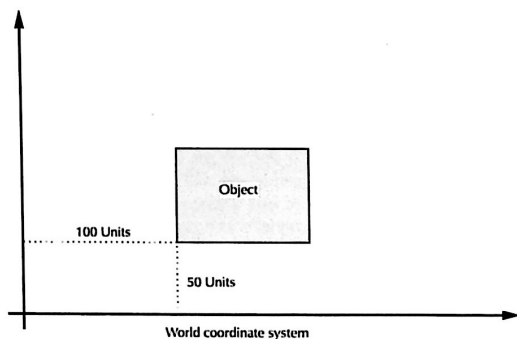
If suitable sequences already exist - because "Record" has been previously activated, then no new keys are created.

After the sequences have been created (or found to be already present), keys are created in accordance with the active options and the current data of the active object stored in them.

The spatial and temporal interpolation of the newly created sequences is automatically set to the values defined in the editor settings (cf. Reference V.1.7.1.).

Only for objects at the highest hierarchy level are the data for position, size and direction identical with absolute values. The key data of a sub-object created by Cinema4D is always relative to the co-ordinate system of the next higher object, because only the usage of relative co-ordinates makes it possible to enter hierarchy animations.

While, for example, the values (100/50/0) of a position key of an individual object actually indicate its (absolute) position in the World Co-ordinate System (Picture 209), the same values (100/50/0) for a sub-object only indicate that it has been moved by 100 units in the X direction and by 50 units in the Y direction relative to the next higher Object Co-ordinate System (Picture 210). Depending on the position of the higher object, this could mean all kinds of positions in the World Co-ordinate System.



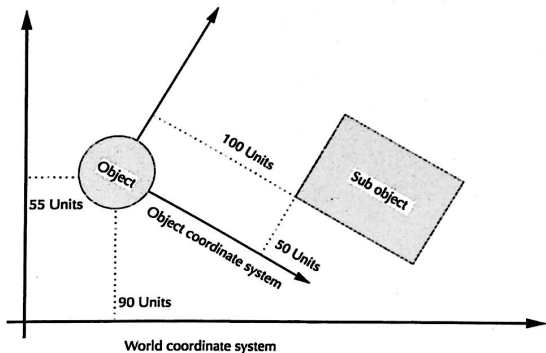
Picture 209

The temporal sequence of the keys can be edited with "Time control" (cf. Reference V.9.10.).

Next Key, Previous Key

These two icons can be used to move to the precise times of particular keys.

One method of changing keys is to set the time for the key and click on "Record" again. No new key is created and the old values are overwritten.



Picture 210

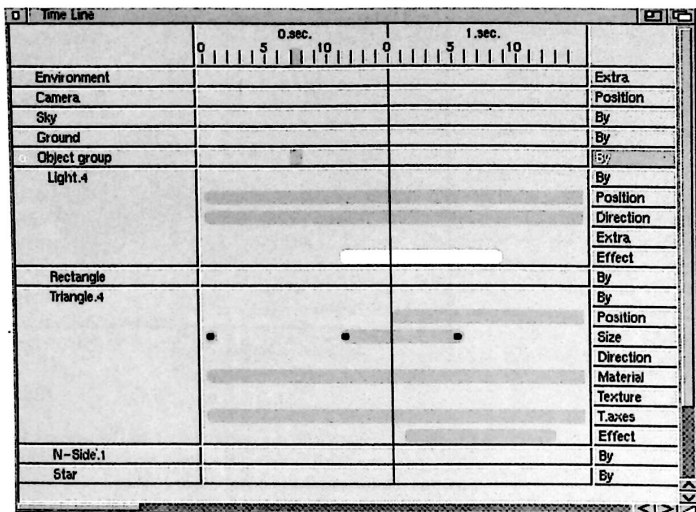
Cinema4D always sets the current time to the nearest key, but only the keys with active "Record" options are taken into account. If, for example, only "Position" is active, Cinema4D will only jump to the nearest position key - even if a direction key is closer. Nothing will happen if no position keys exist.

9.8 Time Line

The "Time Line" is a powerful tool for the detailed editing of an animation. All sequences are displayed on tracks - a bit like the staves in musical notation. The keys can be compared to individual notes and are represented by small black dots in the sequences.

Usage

At the top of the window, the time is represented horizontally. Each second is marked by a vertical dividing line. The visible section of the "Time Line" can be freely moved with the horizontal slider at the bottom margin of the window.



Picture 211

The objects in a document are represented vertically with their tracks. To begin with, however, the objects are closed and only the “Off” track is visible. It indicates when an object is invisible during the animation.

When you click on an object’s name field with the right mouse button, all the object’s tracks are opened. There can be up to eight tracks, depending on the object type. Another click with the right mouse button on the same field will close the tracks again.

Objects containing sub-objects are marked with a solid circle in its own field before the object name. When you click on this with the right mouse button, all sub-objects of the object are opened with their own “Off” tracks. The circle is then drawn as a ring to indicate that they are open. Another click with the right mouse button makes the sub-objects disappear again.

Using this method, you can selectively choose which objects are displayed with their tracks in the “Time Line”. Non-animated objects (the sub-objects of a stationary spaceship, for example) remain closed and this helps considerably in the maintenance of a clear display.

You can also call up most of the other Keyframe menu functions from the “Time Line”, as well as the functions “Copy”, “Paste”, “Cut”, “Delete”, “All” or “None”.

If a sequence cannot be pasted (because there is already another one), it will be omitted. The end of a sequence will be cut off if it exceeds the time section.

The “Undo” in the Time Line affects not only the active object but all objects.

Activation

It is very important for work with the “Time Line” to activate different elements since all functions of the “Time Line” menu always relate to the currently active element. An element can be a single key, a single sequence, a track, all tracks of an object (block) or even all tracks of the object and its sub-objects (hierarchy block).

You can activate the different element using the left mouse button as follows:

Element	Click
Key	Click on a key (black dot)
Sequence	Click on a sequence (bar)
Track	Click on the field with the name of the track on the right
Block	Click on the field with the object name
Hierarchy block	Click on the field with the circle symbol
All	Click on the field in the top left corner

Edit

You can edit the elements instantly by double-clicking rather than single-clicking on them.

Setting New Keys

New keys can be set very quickly with the mouse. To do this, hold down the <ALT> key and click on the part of an existing sequence where you want to create the new key. A window appears for you to enter the key data.

Create New Sequences

New sequences are created by clicking with the left mouse button on a part of a track where there is no sequence so far. This defines the start. Then you click once again on the part where the sequence is to end.

You can abort the creation of new sequences at any time by pressing the <ESC> key.

There must be no existing sequences between the start and end points. The start time must be on the same track as the end time.

Finally, the following windows will appear depending on the track:

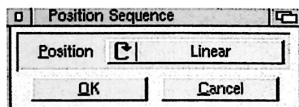
The positions of sub-objects are always interpreted by Cinema4D as relative to the higher Object Coordinate System.

Off Track

No other window appears.

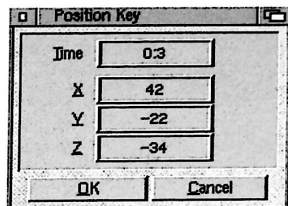
Position Track

Define the type of the position key.



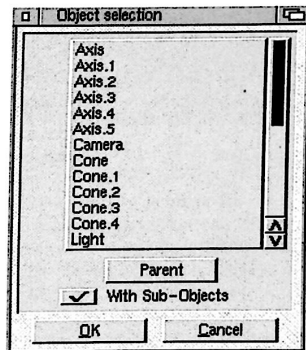
Picture 212

“Linear” creates two keys with position co-ordinates at the start and end of the sequence. Two further windows appear in turn for you to define the co-ordinate values of the two keys.



Picture 213

“As polygon” gives you the object selection window to select a polygon object. Only “open” polygons are accepted 1:1, since the running time can, of course, not be closed. With closed polygons, the polygon is accepted as if it was open.



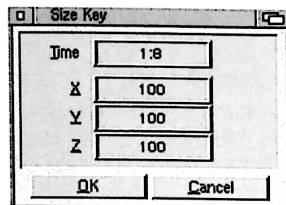
Picture 214

The sizes of sub-objects are always interpreted by Cinema4D as relative to the higher Object Coordinate System.

Cinema4D then automatically converts all control points of the polygon into keys (cf. Basics 20.3.). The time points of the keys are automatically distributed so that the movement on the path occurs at a constant speed.

Size Track

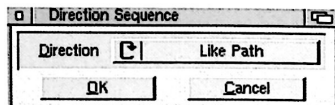
Cinema4D inserts two keys with size values at the start and end of the sequence. Two windows therefore appear in turn, for you to enter the size values of the two keys.



Picture 215

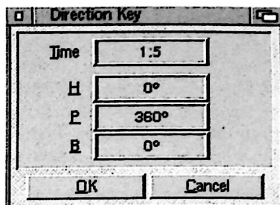
Direction Track

First a window appears for you to define the type of the direction keys.



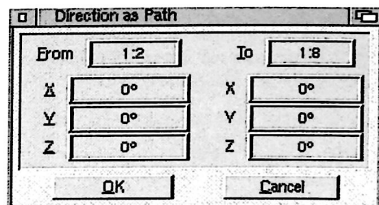
Picture 216

“Linear” creates two keys at the start and end of the sequence with angle values for the heading, pitch and bank angles. Therefore two windows appear in turn for you to enter the angle values for both keys.



Picture 217

With “Like path” you can make the object move along its position path in such a way that the Z axis of the object is tangential to the path. This happens automatically for the duration of the sequence. There is no need, therefore, to define keys.



Picture 218

The directions of sub-objects are always interpreted by Cinema4D as relative to the higher Object Coordinate System.

When you select the function, a window appears for you to specify if the object is to rotate around a certain axis in addition to the automatic orientation. A value of 360 degrees for the Z axis, for example, means that the object will rotate around the path once while moving along it.

“Align to” on the Direction track is used to align objects to other objects during the animation (for example, the laser guns of a space station following a spacecraft flying past).

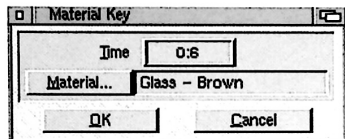
Alignment of an object to its sub-object, or complicated mutual alignments is not possible. However, should you enter one of these, then the alignment may simply be ignored. You can, however, align two objects to each other without any problems.

The Animation path in the editor cannot be drawn fully correctly with these problem cases or with mutual alignments.

“Target point” on the Direction Track can be used to align objects to specific points. With all alignments, only the heading/pitch angles of an object are changed, while the bank angle remains unchanged.

Material Track

Cinema4D inserts two material keys at the start and end of the sequence. Two windows appear in turn for you to enter the names of the two materials which Cinema4D is to interpolate.



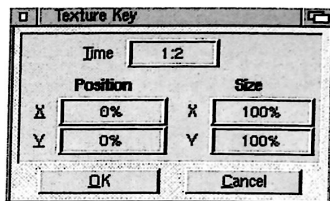
Picture 219

When a material that is required for the animation is deleted, Cinema4D will be unable to execute a material animation.

To animate the textures of a material you need to duplicate the material. It is best to give both a meaningful name, such as “Mat-star” and “Mat-end”. Next you need to enter for both textures the texture picture which is to be reached at the relevant time. This could be, for example, “Picture.0045” for “Mat-start” and “Picture.0112” for “Mat-end”. The intermediate pictures will then be interpolated automatically. It is important that the picture names have a full stop followed by four digits appended to them, or Cinema4D will not recognise the texture animation.

Texture Track

Cinema4D inserts two texture keys at the start and end of the sequence. Two windows appear in turn for you to define the offset and length of the texture, which Cinema4D is to interpolate.



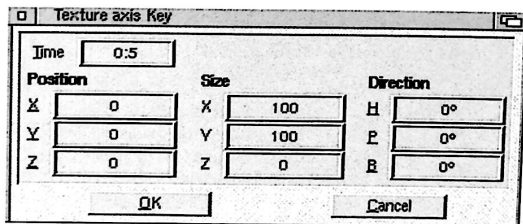
Picture 220

Among the effects achievable by this are, for example, the label on a lemonade bottle moving around the bottleneck, or pulsating rhythmically in size.

The texture axes must always be entered relative to the Object Co-ordinate System.

Texture Axes Track

Cinema4D inserts two keys at the start and end of the sequence. Two windows appear in turn for you to define the position, size and direction of the texture axes which Cinema4D is to interpolate.



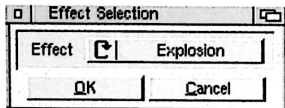
Picture 221

Special effects are not displayed in the editor and must be rendered before they become visible.

One effect that can be achieved by this is, for example, that of a texture rotating in addition to the movement of the object itself.

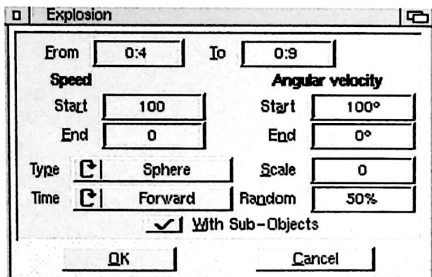
Effects Track

Fantastic effects can be achieved by using the special effects. When you have created a sequence, a window appears for you to set the desired effect.



Picture 222

Explosions Window



Picture 223

This effect makes an object explode with variable parameters. The individual faces of the previously solid object are flying apart. Objects with many faces are particularly well suited for this. If necessary, subdivide the object with the “Subdivide” function (cf. Reference V.4.7.).

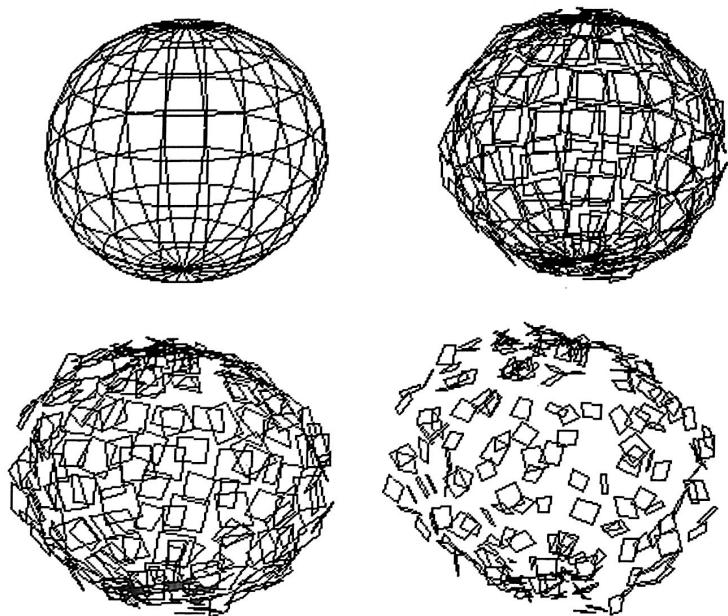
From, To

Start and end time of the explosion.

Type

Here you define how the different faces fly apart.

With “Sphere”, the faces will fly radially in all three spatial directions, while with “Plane” they do this in only two directions. With “Axis”, the faces explode in only one direction.



Picture 224: The explosion effect

Speed

Start and end speed of the faces.

Angle speed

Start and end speed of the rotation of the faces around their own axis (Degree per second).

Scale

Scaling factor - indicates the factor by which the faces have shrunk by the end of the sequence.

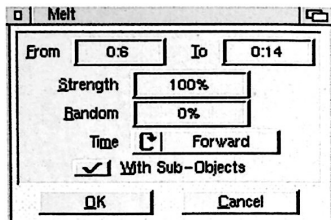
Random

When this option is active, the movement of the faces is not even but randomised.

Time

Here you choose between the effect occurring in a forward or backward direction in time.

Melt Window



Picture 225

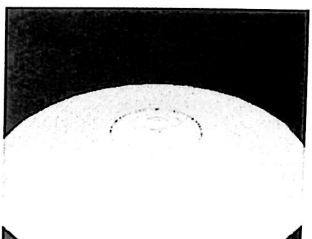
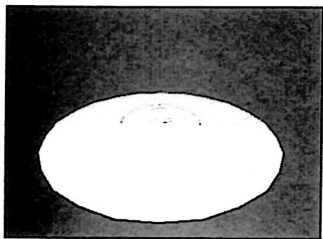
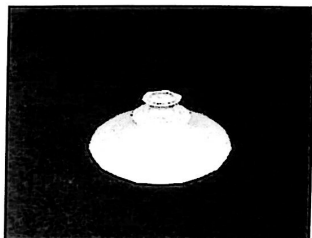
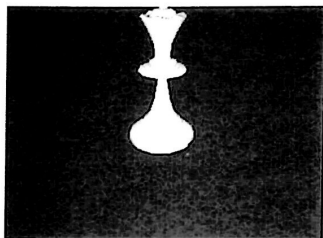
With this effect, an object starts to melt slowly at the lower end of its Y axis. The points of the object at the lower end are moving away radially from the Y axis of the object, as if a puddle was being formed around the object. At the same time, the upper points of the object are sinking downwards until eventually only a flat puddle is left of the object. Objects with many faces are particularly suitable for this. If necessary, subdivide the object with the "Subdivide" function (cf. Reference V.4.7).

From, To

Start and end time of the effect.

Strength

Enter a percentage value for the strength of the effect here.



Picture 226: The Melt effect

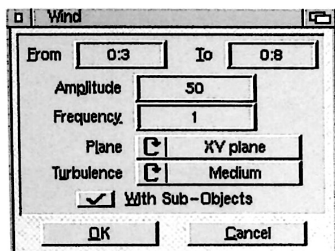
Random

Enter how randomised the movement of the faces is to be.

Time

Here you set if the effect is to run forward or backward in time.

Wind Effect



Picture 227

This effect is used to simulate the effect of agitated air on movable surfaces.

Just enter the wind direction and the strength and the points of the surface will move as if shaken by wind. This is especially useful for flat objects such as flags, with many faces. If necessary, subdivide the object with the “Subdivide” function (cf. Reference V.4.7).

The movement of the points always occurs vertically in relation to the wind direction.

From, To

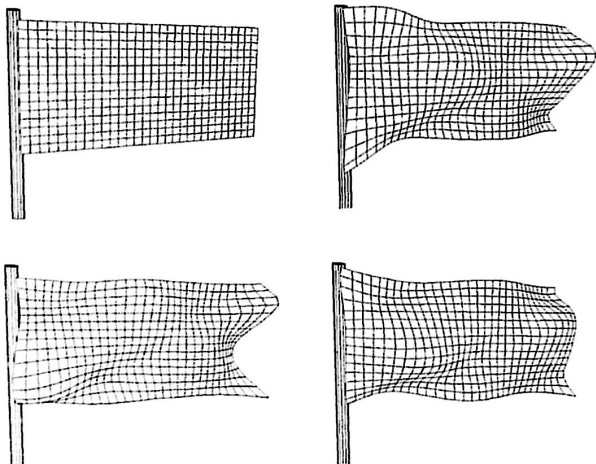
Start and end time of the effect.

Amplitude

Enter the maximum number of units by which the points will be moved out of their resting position.

Plane

Enter the plane in relation to which the movement of the points is vertical.



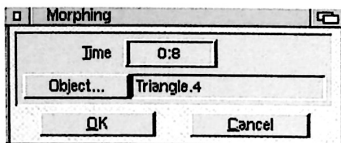
Picture 228: The Wind effect

If, for example, the object axes of a flag are located so that the points of the flag are on the XY plane of the object system, then you should enter “XY plane” here. The points are then moved in the Z direction.

Turbulence

This is used to define the strength of the wind. “None” causes a common movement of all points, as if the surface of the object was rigid, while each of the options ranging from “Low” to “High” simulates increasing wind turbulences. The surface is crumpled realistically by these, just as if a wind was blowing over the surface.

Morphing Effect



Picture 229

This function is used to transform an object smoothly into another one (morphing). The precondition is, however, that both objects have the same number of points and edges.

It is best to take the original object and duplicate it. Then edit the points of the duplicate object so that it assumes the new shape. Enter the duplicate object as the morph object.

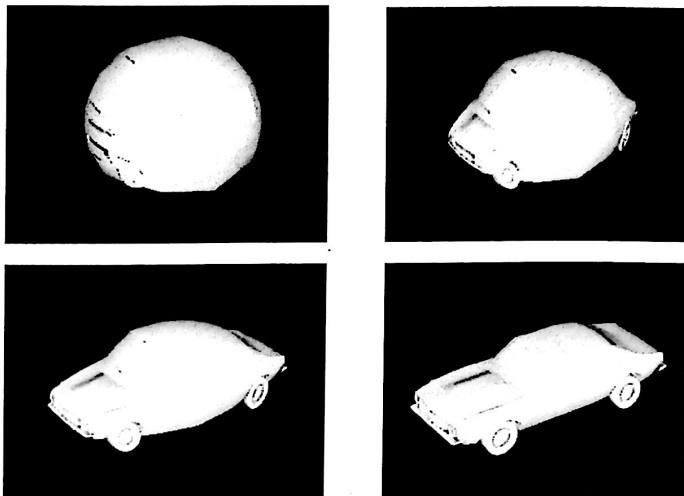
From, To

Start and end time of the effect.

Object

When you click on this field the object selection window appears where you can select the morph object.

If you delete the object named here, Cinema4D will be unable to execute morphing.



Picture 230: The Morphing effect

Pulse Window

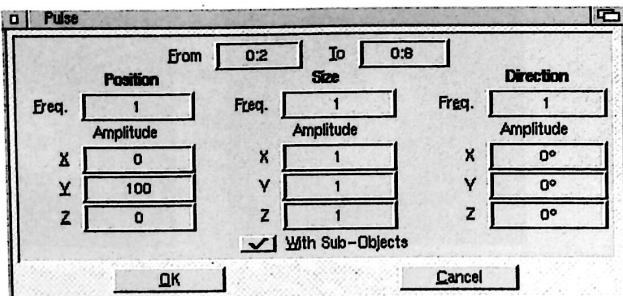
This function only works with object groups. Cinema4D calculates a relative position from the sub-objects, relative to the X axis of the Object Co-ordinate System, of the object group. The further removed an object is, the greater the time offset of the effect. This effect can be used to produce three distinct effects: position, size and direction pulses.

From, To

Start and end time of the effect.

Position Frequency

Enter the frequency here. A frequency of 3, for example, means that an object is moved three times in both directions within the duration of a sequence.



Picture 231

Position Amplitude

Enter the maximum number of units and the direction in which the objects are moved from their resting position.

Size Frequency

Enter the frequency here. A frequency of 3, for example, means that an object is scaled three times in both directions within the duration of a sequence.

Size Amplitude

Enter here the factors by which the object can change in size during the sequence.

Direction Frequency

Enter the frequency here. A frequency of 3, for example, means that an object is moved three times in both directions within the duration of a sequence.

Direction Amplitude

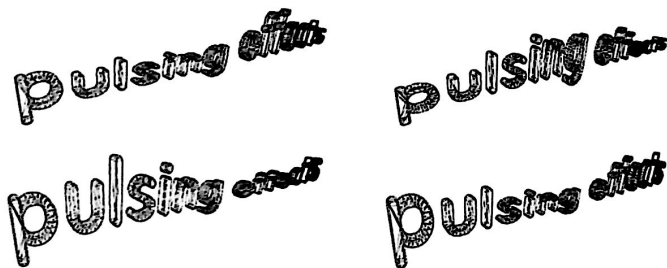
Enter here the number of degree by which the objects will be moved from their resting positions.

With Sub-Objects

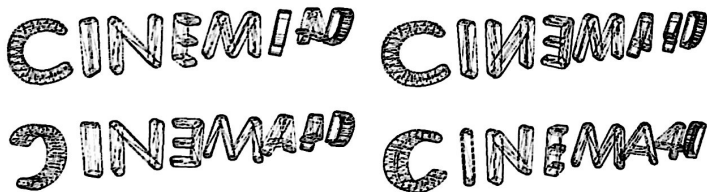
Select whether sub-objects are to also use the special effect.



Picture 232: Position-Pulse effect

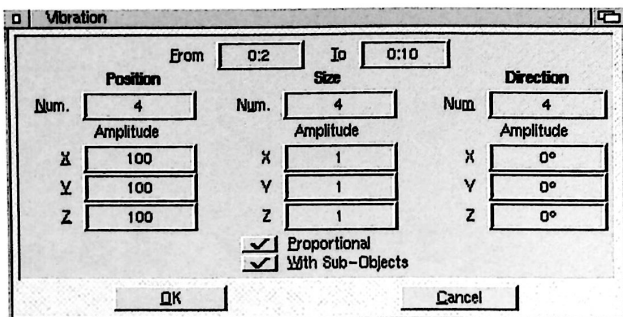


Picture 233: Size-Pulse effect



Picture 234: The Direction-Pulsing effect

Vibration Window



Picture 235

From, To

The start and end time of the effect.

Position Number

Specify the maximum number of random states to be generated.

Position Amplitude

Enter by how much the object is to be moved from its resting position.

Size Number

Specify the maximum number of random states to be generated.

Size Amplitude

Enter the maximum factor by which the object can be changed in size.

Direction Number

Enter the amount by which the angle of the object can be changed.

Direction Amplitude

Enter the maximum degrees by which the object can be turned.

Proportional

This defines whether or not X, Y and Z are to be scaled by the same value.

Parameters track

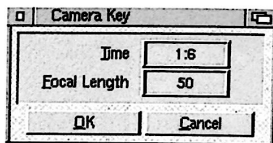
With certain objects (light, camera and environment), not all the tracks of a normal object are present. Other values, however (focus, light source colour etc.) can be animated instead. This is why you find a special "Parameters" track with these objects.

Polygons cannot be animated at all.

When you create a new parameters track, two keys are generated at the start and end of the sequence just like with other tracks.

The following parameters are possible:

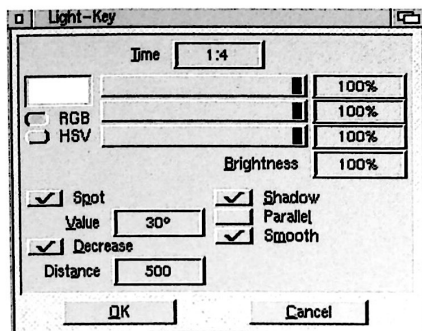
Camera **Focus**



Picture 236

Light

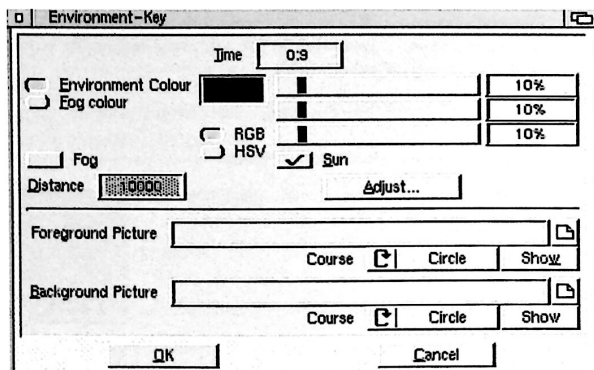
Colour, intensity, decrease, angle



Picture 237

Environment

Foreground picture, background picture, colour of environment fog, diffuse light and sun



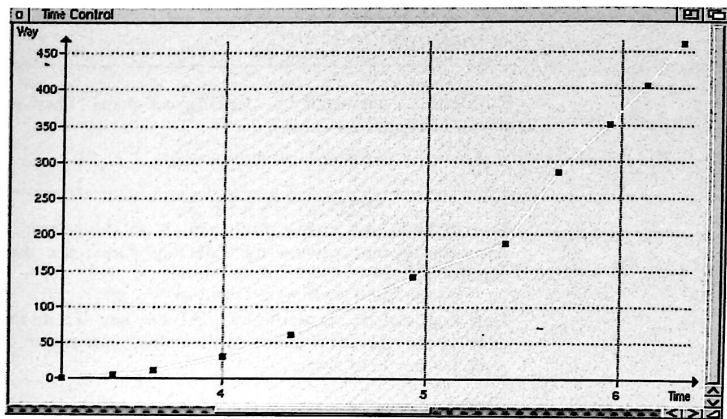
Picture 238

9.9 Time Control

This window gives a graphical representation of the course of a sequence.

The horizontal axis is the time axis. It always starts at 0 seconds, the start of the sequence, and extends for its duration.

The vertical axis indicates the length. By length we mean the distance covered between the keys at any particular time (Picture 239).



Picture 239

Within this co-ordinate system, the time curve of the sequence is displayed. The control points are marked on this curve by small squares.

With position keys, the length is directly equivalent to the path length, which is why the time curve always begins at the origin on the left and rises up to the path length of the sequence.

With size keys and direction keys, the length is to be understood as an abstract change in size or angle between the keys.

For Mathematicians:

The keys (position, size and direction) with their triple values define control points for interpolation paths, whether in (real) space or in an abstract angle space. The length on these paths is calculated from the arc length.

Each component of a vector (key) has an equal effect on the arc length.

Activation

Keys can be activated by clicking on them. They are then shown in a different colour.

Edit

To edit keys, you either double-click on the relevant key or select the key and activate the “Edit key” function in the “Time control” menu.

New keys can be set with the <ALT> key. To do this, just click on the relevant position in the co-ordinate system with the <ALT> key held down.

Delete

Active keys can be deleted with the key or the “Delete” function in the “Edit” menu.

The following fields can be found at the top of the window:

Track

If the “Time control” window is open while you are editing the “Time Line”, the track type of the active sequence is shown here.

However, if you open this window without the “Time Line”, you can use it to enter the track type (position, size, direction).

If no sequence is present at the current time in the active object track, nothing is displayed in the Time control window and the other fields are disabled.

Type

Here you can switch between displaying the length changes per second (Length-time) or the speed per second (Speed-time).

Space

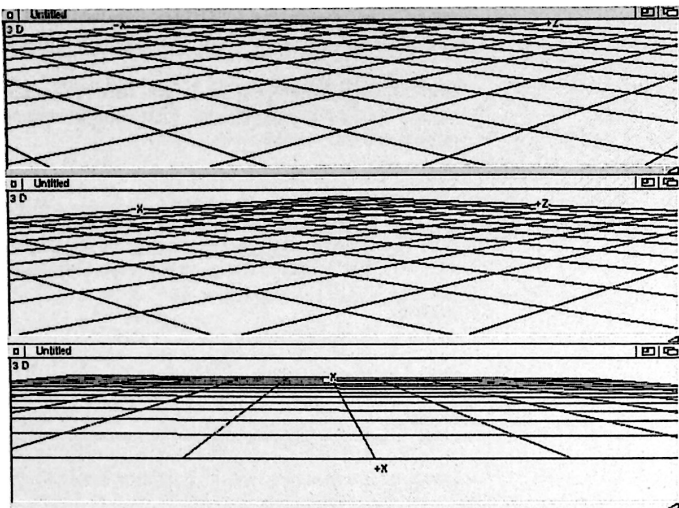
Spatial interpolation type (cf. Reference V.6.13.).

Time

Temporal interpolation type (cf. Reference V.6.13.).

9.10 Arrange

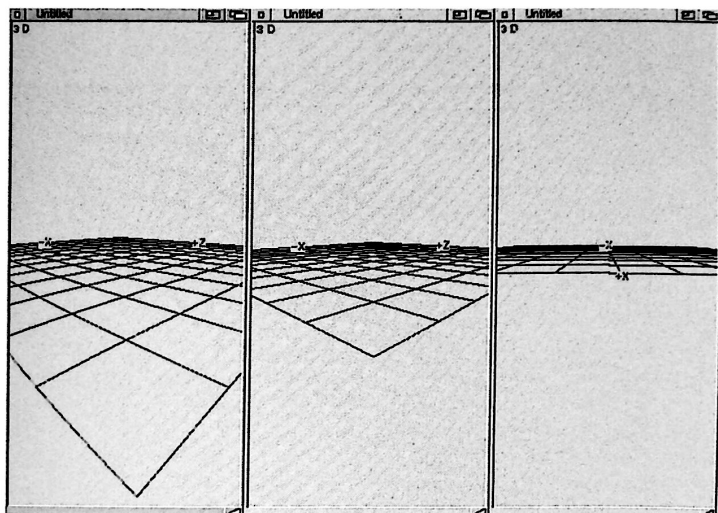
This menu item contains several functions for arranging multiple document windows.



Picture 240

9.10.1 Horizontal

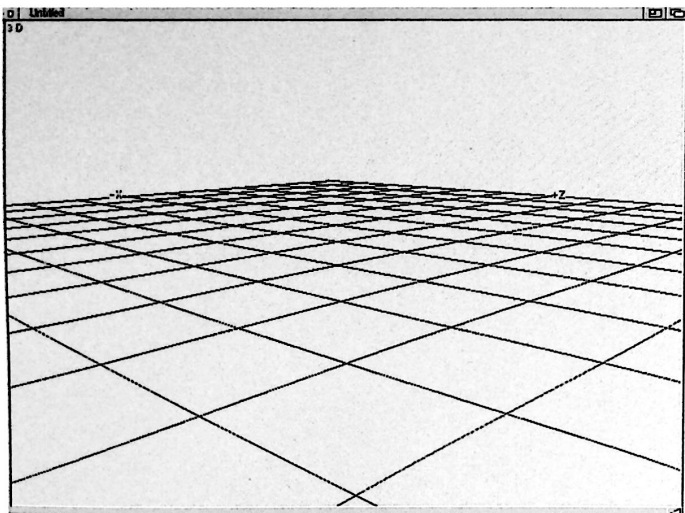
This function enlarges all document windows to the full screen width. Their height is adjusted so that the program can stack the document windows vertically (Picture 240).



Picture 241

9.10.2 Vertical

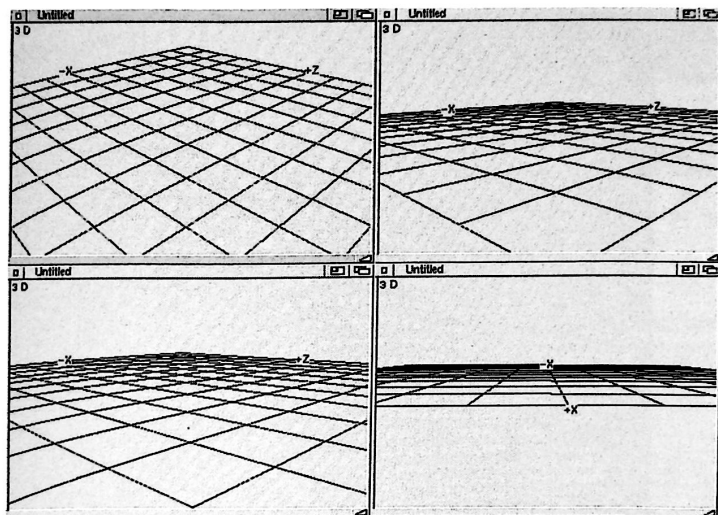
This function enlarges all document windows to the full screen height. Their width is adjusted so that the program can place the document windows side-by-side (Picture 241).



Picture 242

9.10.3 Full size

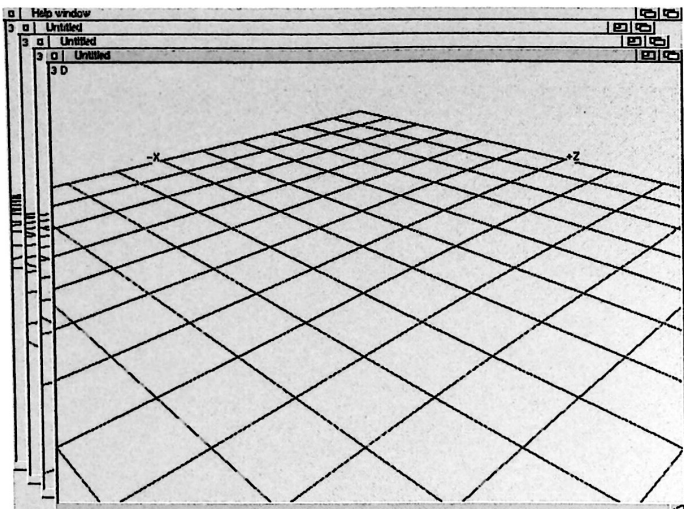
This function sets the active document window to the full screen size (Picture 242).



Picture 243

9.10.4 Overview

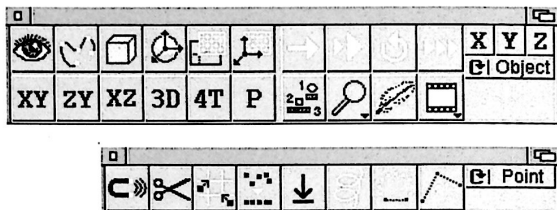
All existing document windows are positioned and adjusted in size for their best fit on the screen so that all windows are visible. The program attempts to make each document window as square as possible (Picture 243).

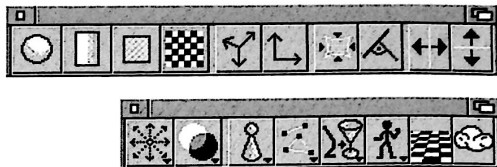


Picture 245

9.10.5 Offset

All existing document windows are slightly offset against each other, starting from the top left corner of the screen (Picture 244).





Picture 246

9.10.6 Horizontal Toolbar

This function changes the appearance of the currently active toolbar. Cinema4D has two shapes for all toolbars, horizontal and vertical (Picture 246).

The shape of the toolbars is saved with the layout!

VI. The Ray-Tracer

1. Basics

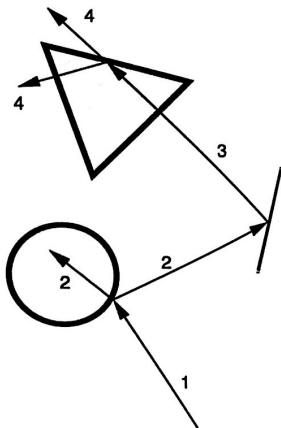
Raytracing is probably the oldest method of generating life-like pictures with a computer. The raytracing method copies nature by attempting to simulate the diffusion of light using physical laws and mathematical formulae.

To do this, a few thousand of the light rays emanating from a light source (for example, a simulated light bulb) are selected and their path is traced. Some rays encounter objects, these are then reflected, refracted or absorbed by them. Others disappear into infinity (Sky) or hit the Ground of the scene. Only a small part of these rays eventually ends up directly or - as a result of reflection - indirectly in the focal plane of the camera simulated by the computer screen. At this point, you can now calculate the intensity and colour of the pixels.

It is easy to see, however, that this method, although physically correct, is not particularly efficient since an enormous number of rays need to be calculated while it is not even certain that they will ever make it to the screen. For this reason, the procedure is today applied in reverse. That is, the rays “start” in the camera focus. From them, the program selects precisely those which pass through a screen pixel. Then the program traces the path of these rays through the scene, until they meet objects, the Ground or the Sky. It calculates the intensity at the intersection point, caused by the lighting of the scene with a light source.

If realistic shadows are to be rendered, too, the program needs to calculate rays from the intersection point to the light source to determine if one or more objects are located between the two.

If the program is also expected to render reflections, it needs to calculate a reflected ray, starting with the intersection point, and including further intersection points and further shadow rays. More rays are required for the rendering of transparency and light refraction.



Picture 249

Hence the original ray branches out like a tree into ever more reflected and refracted light rays (Picture 249).

But since the processing power and the memory storage of a computer are finite resources, the program stops at a user-defined calculation depth. Once the program has reached this point, it combines the intensities found at the intersection points into a total intensity value which determines the intensity of the pixel at which the ray originated.

To add colour to the picture, the intensities are calculated separately for the three primary colours red, green and blue.

Although this method only traces rays which are relevant for the intensity of a pixel, the required processing power is still gigantic. After all, the program needs to go through all objects in the scene such as trees, houses, cars etc. for each ray separately, and calculate their intersection points with the ray. The one nearest to the starting point of the ray is the one taken. Even if computers are capable of executing such calculations in split seconds, several millions of them need to be done for an average scene.

It is readily comprehensible therefore why even mainframe computers cannot calculate reasonably life-like pictures in a reasonable time without acceleration algorithms. Besides many other such tricks, the Voxel Method was developed a few years ago to minimise the processor time required for the calculation of these intersection points. Many rays obviously only hit a few of the objects in a scene. It would therefore be desirable if the program only had to do its calculations with these few objects.

To achieve this, the voxel method divides the space in which the scene is located into cubes, also referred to as voxels (as a three-dimensional counterpart to the two-dimensional pixel). The program now determines which of these voxels actually contain objects and remembers which objects are in which voxels. When the program then begins to calculate which objects a ray will encounter, all it has to do is "look up" which voxels the ray will go through. Empty voxels are simply skipped. Only when the program finds a voxel with contents will a calculation involving the few objects in it be necessary. All other objects need not be taken into account any longer.

The amount of time saved by this approach is enormous. A computer like the Amiga may still, of course, take several hours to render a complex scene, but owners of co-processors and acceleration cards will benefit from much shorter rendering times.

Cinema4D goes one step further in optimisation. The Cinema4D Ray-Tracer is an adaptive Ray-Tracer. For many parts of the picture, it is not necessary to calculate reflected or transmitted rays and the Ray-Tracer will simply fall back on the so-called scanline algorithm which again saves a lot of rendering time.

2. Usage

The Cinema4D Ray-Tracer was designed as a standalone program. This means that you can start the Ray-Tracer from within the editor or use it separately in order to have maximum memory space available.

When you start the Ray-Tracer on its own, the file requester window will appear first for you to enter the scene to be rendered. The Ray-Tracer will then start its work immediately. A window shows the progress made.

The Ray-Tracer was programmed to enable it to run in the background while you are busy constructing a new scene in the editor. When the Ray-Tracer is started, it is assigned the priority which you have defined in the Cinema4D editor settings.

3. CLI Usage

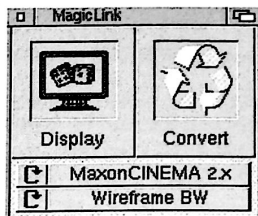
You can even run the Ray-Tracer from the CLI. It expects the name of the scene as an argument.

To render several scenes in one go, you need to create a script file. In this script you can pass the “NOWAIT” option to the Ray-Tracer which prevents it from stopping and waiting for you to click on the close gadget after rendering the first picture. The Ray-Tracer will finish its work immediately on completion of a rendered picture and the computer can continue to work its way through the script.

If you use the “NOREQS” option in addition, you can disable all error and other messages. This is particularly useful when you want to have several pictures rendered overnight. An error in one of the pictures will then not stop the Ray-Tracer to wait for user input but it will continue with the rendering of the remaining pictures.

VII. MagicLink

MagicLink is one of the most powerful object converters for 3D programs available today in the Amiga market. MagicLink is supplied with Cinema4D.



Picture 250

MagicLink is the only program at the moment capable of flawlessly converting materials, textures and hierarchies. It can even convert entire drawers, not just individual files.

With its comprehensive configuration options, MagicLink offers an almost perfect conversion tool tailored to your individual requirements.

MagicLink also knows about the AppWindows technology. Instead of selecting a file in the file requester window, you can simply drag an icon from the workbench into the MagicLink main window. Depending on whether you release the icon over the “Display” or “Convert” icon, the corresponding action will immediately be executed. You can also drag the icon into any other MagicLink window, where it will then be displayed.

MagicLink converts the following file formats: Cinema4D, DXF (3D Studio compatible), Fastray, Imagine, Pagerender, Reflections, Sculpt, Turbosilver, Videoscape

All the functions of MagicLink are listed in the sequence of the menus.

Project

Instead of this menu item, you can also grab an icon from the workbench and drop it over the “Display” icon.

Display

Display works in the same way as the “Display” icon in the MagicLink window. When you select this menu item, a file requester window appears for you to select an object file. You need not specify the format of the object file since MagicLink will automatically recognise it. After you click on “OK”, MagicLink loads the file into memory. If the 3D window is open, it will be shown in the scene display.

Convert

“Convert” has the same function as the “Convert” icon in the MagicLink window. As with “Display”, a file requester window for the selection of an object file is opened. With “Convert”, however, MagicLink loads the object and immediately converts it.

Another file requester window opens after the object has been loaded, and offers a save path and object name. Upon confirmation, MagicLink converts the object. The destination format of the conversion can be defined in the “Output format” window.

Convert Displayed Object

This function works like “Convert” but uses the scene which is currently in memory rather than loading a new object file.

Convert Drawer

The “Convert drawer” menu item provides an excellent tool for automatically converting several scenes into a new format.

An example will illustrate this:

You want to convert several existing scenes which were created with various programs, into Cinema4D format for an animation. To do this, copy the required scenes into a common directory. Set the file format in the “Output format” window to “Cinema4D”. Select the menu item “Convert drawer” to convert all scenes.

The file requester window appears and waits for your input. You select the drawer containing the scenes to be converted. Then you will again be prompted, this time to select the destination drawer to which the converted files are to be saved.

MagicLink now begins the conversion procedure. All the files in the original drawer will be tested for compatibility with MagicLink. The drawer can contain files of many different types. Any files not recognised by MagicLink as 3D object files will simply be ignored.

About

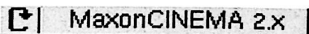
“About” opens an information window containing details about the program version, the product number and the distributor and support address.

Quit

“Quit” automatically saves your working parameters and quits MagicLink.

Window

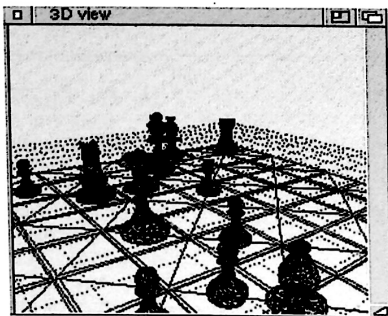
Output Format



Picture 250

Select from the various file formats, the export file format that MagicLink is to produce.

3D Display



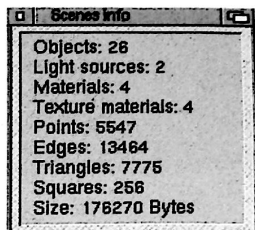
Picture 251

This window shows the object file to be displayed or converted, taking into account the settings made in Camera Control. You can change the display mode in the “Settings” menu, switching from Wireframe to shaded and vice versa.

The left mouse button changes the orientation. If the SHIFT key is pressed simultaneously, the distance of the camera from the scene can be controlled by moving the mouse left or right, or the zoom factor by moving up and down.

Scene Info

This window gives you all the available information on the object file in memory. This is important, for example, if you are working with programs which impose restrictions on scene and object files.

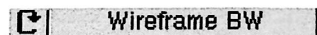


Picture 252

Preferences

Display Options

Here you can select how the object should look in the display window. The current setting is shown in the main MagicLink window (Picture 253).



Picture 253

Recursion

This menu item applies to batch conversions. When "Recursive" is selected, the source drawer will be searched recursively for further files. When this option is not active, however, files in subdirectories are not converted.

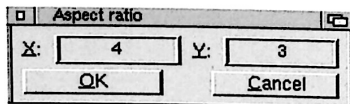
Prompt for Target

When this option is selected, MagicLink will ask you for the output path before every conversion. Without this option, saving will be done automatically. To ensure that the source files are not overwritten, MagicLink append a special extender - depending on the output format - to the filename.

File Prompts

Here you can tell MagicLink whether or not you want a safety alert before a file is overwritten. With this option enabled, nothing untoward can happen, i.e. you will not lose any files as long as you give the correct reply to the safety alert.

Aspect Ratio



Picture 254

Here you set the picture aspect ratio. Normally this is 4 to 3.

You can determine the aspect ratio of your monitor by measuring the width and height of the visible picture and entering these values into the text field in this window.

Import Modules

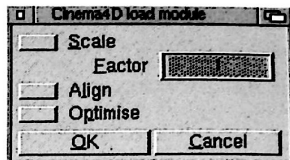
Below are descriptions of all the MagicLink import modules.

Cinema4D

This module gives you access to all Cinema4D data.

Scale

At the present time, none of the editors on the market - except Cinema4D and Lightwave - supports absolute co-ordinates in the sense of units of measurement. Each editor uses different "units". Internally, therefore, the size of the scene is multiplied with a value based on experience when converting from one format to another. This is totally transparent to the user.



Picture 255

This function also allows you to change the size of the object to be loaded. A factor of three, for example, triples the size of the object.

Align

Some programs assume that the faces of an object have a common orientation. Mathematically, the sequence of the corner points produces a rotation direction. Using this rotation direction, it is possible to calculate a ray vertical to the face - the normal vector - which plays an important role in the calculation of colour graduations and shadows. If adjacent faces have a different orientation, the normal vectors are pointing into opposite directions. With some programs, this can produce unsightly colour transitions in the rendered picture. MagicLink corrects all adjacent faces so that they have a common orientation.

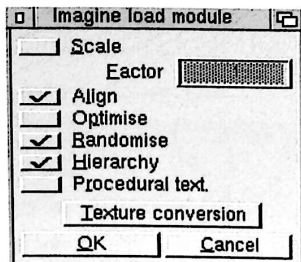
Cinema4D automatically generates all objects in this way, so you will probably not use this option very much. It should normally be disabled as it requires a lot of processing power.

Optimise

This option removes duplicate or invalid points, faces and edges. This is not normally necessary with Cinema4D, but can be useful on occasion. You should only enable optimisation when really needed as duplicate points are inserted into some objects in order to produce hard edges.

Imagine & Silver

This module is used to import data created with the programs Imagine Versions 1.0 to 3.0 and Turbosilver.



Picture 256

Scale, Align and Optimise

cf. Cinema4D import module.

The “Optimise” option is not normally required. “Align”, however, should always be selected when converting to the Cinema4D and Reflections formats since Imagine creates objects with unaligned faces.

Randomise Edges

Cinema4D uses an algorithm which randomises all object edges. This has the advantage that objects are recognisable before their edges have been fully drawn, thus cutting down on time spent waiting for screen redraws. This option is used to randomise the edges of Imagine objects. This option does not take much time and is recommended when you convert objects to Cinema4D format or when you need a quick preview on the MagicLink screen.

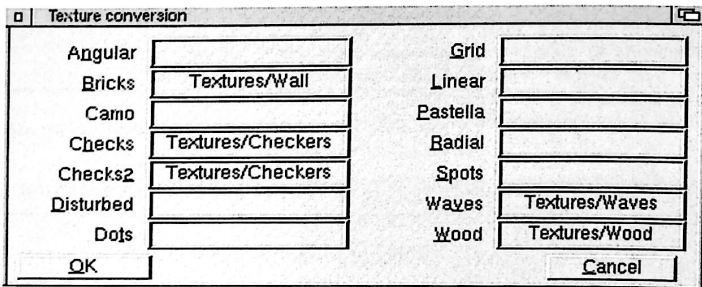
The “Apply to child objects” option in Imagine cannot be converted. The best solution is to only assign one texture per object in Imagine and to try and manage without this option altogether.

Hierarchy

You can disable this option if you do not want to convert the Imagine hierarchy.

Procedural Textures

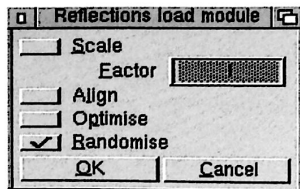
Not all editors know about the use of procedural textures. This option makes MagicLink substitute an appropriate IFF texture for each procedural texture. Depending on the IFF picture, the substitution will work with varying degrees of success. You can set the substitution paths for the most common Imagine textures in “Texture substitution”. All other procedural textures are converted into an IFF texture of the same name.



Picture 257

Reflections

This module is used to import data from the program Reflections Versions 1.0 to 2.5.



Picture 258

Scale, Align, Optimise and Randomise Edges

cf. Cinema4D or Imagine import modules.

“Align” and “Optimise” are not normally needed as the Reflections program generates correctly aligned objects.

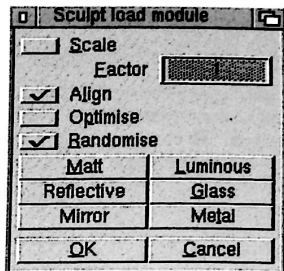
Sculpt

This module is used to import data from the programs Sculpt 3D/4D (all versions).

Scale, Align, Optimise and Randomise Edges

cf. Cinema4D or Imagine import module

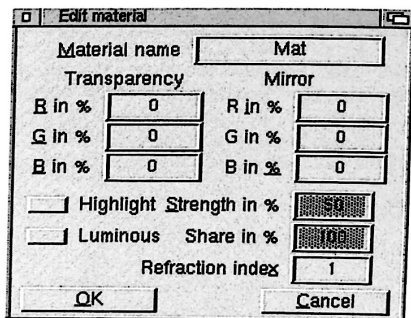
The “Optimise” option is not normally needed. “Align”, however, should always be used when converting into the Cinema4D and Reflections formats as Sculpt generates objects without aligning the faces.



Picture 259

Materials

Sculpt does not support a multitude of materials like other programs. It can only use a limited number of predefined materials. When you click on one of the fields from “Matt” to “Metal”, you can specify a number of additional attributes in the “Edit material” window. These will then replace the values predefined in Sculpt.

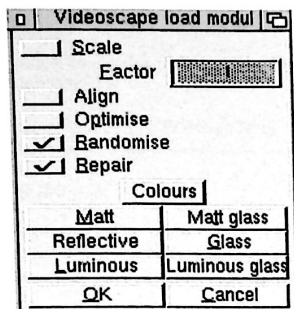


Picture 260

Cinema4D	Sculpt
Matt	Dull
Shiny	Shiny
Reflective	Mirror
Luminous	Luminous
Glass	Glass
Metal	Metal

VideoScape

This model is used to import data from the programs Videoscape (all versions) and Modeler 3D (all versions).



Picture 261

Scale, Align, Optimise and Randomise Edges

cf. Cinema4D and Imagine import modules.

“Align” and “Optimise” are not normally required with Videoscape as Videoscape generates correct objects.

Repair

This function prevents the loading of defective squares, because Videoscape permits squares whose corner points are not on the same plane. Other formats, such as Cinema4D, do not tolerate such squares. This function subdivides a defective square into two triangles. It is a good idea to always leave this function active as it does not need much processing time and can avoid a lot of trouble.

Colours

The original Videoscape format had a slightly different colour palette from that in the later version, "Modeler 3D". You can switch between these palettes using the "Modeler palette" and "Videoscape palette" fields.

Videoscape can only use 16 different basic colours. MagicLink converts each basic colour into a different material.

When you click on "Colours", another window appears for you to enter a name for the material replacing each of the 16 basic colours. In addition, you can define with three hexadecimal values (red, green and blue) the colour values to be assigned to the material. Black, for example, is "000", pure white "FFF" and red "F00".

Materials

Videoscape does not support a multitude of materials like other programs. It can only use a limited range of predefined parameters. When you click on one of the fields from "Matt" to "Luminous glass", you can assign a number of additional attributes to the relevant material in the "Edit material" window.

Cinema4D

Matt

Matt glass

Shiny

Glass

Luminous

Luminous glass

Videoscape

Opaque

Matt transparent

Glossy opaque

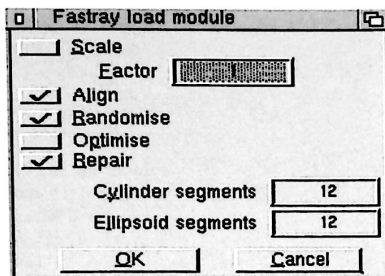
Glossy transparent

Unshaded opaque

Unshaded transparent

FastRay

This module is used to import data from the program Fastray (all versions).



Picture 262

Scale, Align, Optimise, Repair and Randomise Edges

cf. Cinema4D, Imagine and Videoscape import modules.

The “Optimise” option is not normally required. “Align”, however, should be active when converting into Cinema4D and Reflections formats since Fastray creates objects with unaligned faces. “Repair” should always be selected.

Cylinder end Plates, Cylinder Segments and Ellipsoid Segments

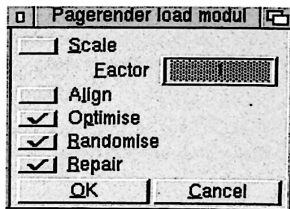
Fastray is the only program (apart from Real 3D) that supports mathematically exact cylinders and ellipsoids. These are not approximated with a number of faces but are modelled using a mathematical function. When converting to another program, such cylinders and ellipsoids must be subdivided into a series of faces.

The value “Cylinder segments” is to define how smooth the cylinder is to appear afterwards. The more segments you specify, the rounder the cylinder will be and the more faces it will have.

The higher the values entered, the rounder the approximation using triangles and squares will be.

PageRender

This module is used to import data from the program Pagerender (all versions).



Picture 263

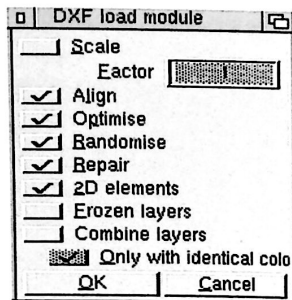
Scale, Align, Optimise, Repair and Randomise Edges

cf. Cinema4D, Imagine and Videoscape import modules.

“Optimise” should certainly be active to avoid wasting a lot of memory space.

DXF

This module is used to import DXF files. The DXF format enables data transfer between the Amiga and IBM-compatible PCs.



Picture 264

The DXF format (originally used by AutoCAD) is supported by many programs, especially CAD software, on the PC.

Scale, Align, Optimise, Repair and Randomise Edges

cf. Cinema4D, Imagine and Videoscape import modules.

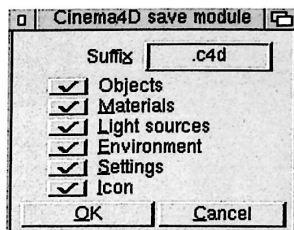
“Optimise” should always be active to avoid wasting a lot of memory space.

Export Modules

Below is a description of all the MagicLink export modules.

Cinema4D

This module is used to save a scene in the Cinema4D file format.



Picture 265

Suffix

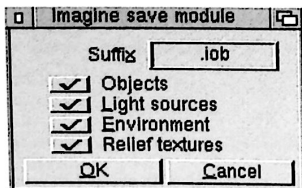
Enter the extender to be appended to the name of the converted file. This is not strictly necessary for Cinema4D but makes it easier to distinguish between converted and original objects - especially when located in the same directory on your hard disk.

You can set selectively whether you want to save “Objects”, “Materials”, “Light sources”, “Environment data” and/or “Settings”.

The “Icon” option can in addition be used to specify if icons are to be generated.

Imagine & Silver

This module is used to save a scene in the Imagine file format.



Picture 266

Suffix

cf. Cinema4D export module.

You can set selectively whether you want to save “Objects”, “Light sources”, “Environment” and “Relief textures”.

The “Relief textures” option indicates if such textures are to be converted.

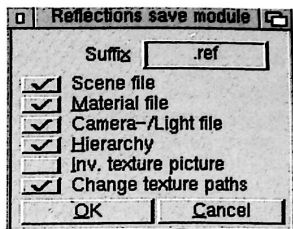
Reflections

This module is used to save a scene in the Reflections file format.

Suffix

cf. Cinema4D export module.

You can select whether you wish to create just a “Scene file”, “Material File” or “Camera file”.



Picture 267

Hierarchy

Reflections does not support true hierarchies. Since it is not always desirable to use its pseudo hierarchies, you can disable this option.

Inverted Texture Picture

Like Cinema4D, Imagine supports mirrored texture pictures. It does not, however, always render such textures correctly. Therefore MagicLink does not normally convert this attribute.

Change Texture Paths

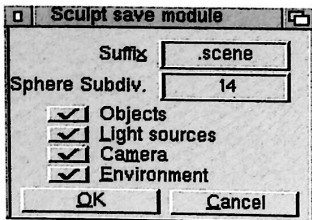
Reflections expects all textures to be in the drawer REFL_TEXTURES:. This option, if active, converts all texture paths, so that, for example, "df0:dp/textures/Marble" becomes "REFL_TEXTURES:Marble".

Sculpt

This module is used to save a scene in the Sculpt file format.

Suffix

cf. Cinema4D export module.



Picture 268

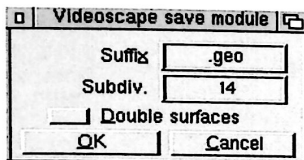
Sphere Subdivide

Sculpt does not support mathematically precise spheres. Enter the number of subdivisions to be applied to such a sphere during conversion.

You can set selectively whether you want to save “Objects”, “Light sources”, “Camera data” and “Environment data”.

VideoScape

This module is used to save a scene in the Videoscape file format.



Picture 269

Suffix, Sphere Subdivide

cf. Sculpt export module.

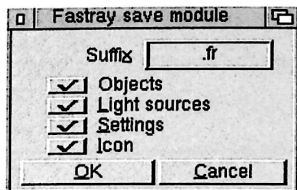
Duplicate Faces

It is extremely important with Videoscape to ensure that all faces have the same orientation, as the lighting model depends on this. Adjacent faces of different orientations can produce severe anomalies with shadows.

This option enables you to, at least partially, avoid this problem. All faces are duplicated, each with two opposite orientations. The disadvantage is the slower rendering speed and the higher memory requirement.

FastRay

This module is used to save a scene in the file format of the program Fastray.



Picture 270

Suffix

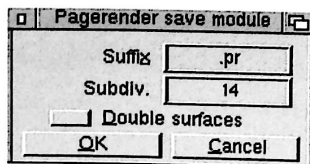
cf. Cinema4D export module.

You can set selectively whether you want to save “Objects”, “Light sources” and “Settings”.

The “Icon” option can in addition be used to specify if you want icons generated.

PageRender

This module is used to save a scene in the file format of the program PageRender.



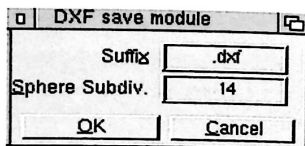
Picture 271

Suffix, Sphere Subdivide, Duplicate Faces

cf. Sculpt and Videoscape export modules.

DXF

This module is used to save a scene in the DXF file format.



Picture 272

Suffix, Sphere Subdivide

cf. Sculpt export module.

VIII. Ancillary Programs

ANIMGen

When you have rendered a number of pictures with the Cinema4D animation function, you can use the supplied ANIMGen program to combine them into a playable animation that can be played back with ViewTek.

Clouds

Clouds is a simple program for the creation of cloud pictures. After starting the program you are asked for the resolution at which the cloud textures are to be rendered. You can then enter the so-called "Smoothing factor". A value of 2, for example, means that the texture is smoothened twice after rendering. Finally you can enter the name under which the texture is saved. You can simply press the RETURN key to view the picture without saving it.

Cycle to Menu

The CycleToMenu program simplifies the selection of options enormously by the use of so-called cycle gadgets. Detailed documentation concerning its installation and use can be found in the drawer "CycleToMenu".

ViewTek

Cinema4D is supplied with the universal picture display program ViewTek. ViewTek can be used to display ordinary pictures and animations in the IFF format. There are different versions of ViewTek for different graphics cards. The program is capable, however, of displaying 24-bit and JPEG pictures on Amigas without a graphics card. To do this, the program automatically reduces the 16 million colours to the displayable number of colours.

Appendices

Bibliography

1. J. Foley, A. van Dam, S. Feiner, J. Hughes

Computer Graphics Principles and Practice by Addison-Wesley

Very good standard volume, covers almost all areas, up to date.

2. W. Newman, R. Sproull

McGraw-Hill

Good book that is suitable for beginners, but no longer fully up to date.

3. D. Rogers

Procedural Elements for Computer Graphics

McGraw-Hill

4. Proceedings of SIGGRAPH 76 to 94 in Computer Graphics

ACM SIGGRAPH, New York

Published annually, handbook of the world's largest computer graphics show with up-to-date research reports, highly recommended.

ASCII

International character set, covering 255 different characters. Characters 0 to 31 are special control code characters and of no interest to Cinema4D. Numbers 32 to 64 are characters such as "!" or "\$". The actual letters begin in alphabetical order with number 32 and range up to number 122.

The characters from number 123 to number 255 differ depending on the computer system and are reserved for special and accented characters.

Asynchronous

Used to describe programs which permit the concurrent use of several windows. Changes made in one window have an immediate effect on the others. The user can enter data in any order.

By contrast, sequential programs force the user into a fixed mode of working. Changes are not made in real time but only after calling and executing certain functions.

Bit plane

The part of memory in which the graphics data of a picture are stored. Each set bit corresponds to a pixel. With one bit plane you can therefore display 2^1 = two colours.

If two bitplanes are used, two bits can be stored for each pixel, i.e. 2^2 = 4 colours are possible. Cinema4D uses 24 bitplanes when rendering the pictures, that is 2^{24} or more than 16 million colours.

Body

All objects that are composed of triangles and square are referred to as bodies.

CLI

Input window of the Amiga operation system. Here you can enter commands from the keyboard rather than select them with the mouse.

Contour

Polygon which is moved along a path.

Co-ordinate system

To tell Cinema4D where a particular object is located, you need to enter its co-ordinates. These always relate to a particular co-ordinate system. Cinema4D distinguishes between the World Co-ordinate System, the Object Co-ordinate System, the Screen Co-ordinate System, Camera Co-ordinate System and texture co-ordinate system.

Document

Window in which a scene is displayed.

EHB

Special Amiga screen mode. It doubles the number of available colours from 32 to 64. Almost without importance on the newer Amiga models A1200 and A4000.

Environment

For Cinema4D, this term includes the Ground, the Sky, the "editor" camera, the environment colour, environment fog, the foreground and the background.

Field

Gadget, button, switch.

HAM

Ham is an acronym for “Hold And Modify”. This is a special Amiga screen mode. Offers up to 4096 colours (HAM6) or 262144 colours (HAM8). The colours are subject to certain restrictions so you may get unsightly margins and other abnormalities.

Highlight

White spot on a shiny surface caused by light. Gives a surface increased three-dimensionality.

HSV system

Definition of a colour by Hue, Saturation and Value.

Main toolbar

Icon bar which appears on the left side of the screen when Cinema4D is started. The icon bar is always present.

Icon

An icon is an element of the user interface that consists only of a graphic and is not labelled with text.

Interpolation

Cinema4D uses interpolation to calculate intermediate values between the individual control points of a curve. A distinction is made between linear interpolation, which links the control points simply with straight lines, and Spline interpolation which links the points with a soft curve.

Inverse Kinematic

Enables the correct movement of hierarchical object structures. For example, all parts of an arm will move when the hand of a modelled arm is moved.

Keyframe/key

Key picture in an animation. Defines position, size and orientation of an object at a particular time.

Length

This parameter defines the maximum duration of an animation in seconds.

Material

Description of surface attributes such as colour, reflectivity and transparency which can be assigned to an object.

Moiré

Name given to the effect obtained when two grids - for example two kitchen sieves - overlap. The human eye will then see stripes and patterns which change when the angle at which the two grids stand to each other is changed.

Such patterns can also appear in rendered pictures when the screen "grid", made up of a certain number of pixels, overlaps with the regular pattern of a texture, for example a chequered pattern on the Ground.

Multitasking

The Amiga's operating system is capable of running several programs simultaneously. You can switch between the applications at any time.

Non-modal

Used to describe input windows which are always open and functioning. This enables you to make input very quickly without having to open and close the input windows all the time.

Normal vector

For each level surface it is possible to mathematically calculate a vector which is exactly vertical to the surface. This is of fundamental importance for rendering the brightness of a surface.

Object

In Cinema4D, bodies, light sources and polygons are called objects. These objects have in common that they are visible in the editor and drawn there. Functions like the clipboard or Move, Rotate and Scale can be applied to all objects.

In addition, there are the special objects “Perspective camera”, “Ground” and “Sky”. These can only be present once.

Object group

A Cinema4D object can have several sub-objects. The object is then referred to as an object group because it groups the sub-objects.

Overscan

A setting that allows a slightly higher resolution in some screen modes (usually up to 10%). The unused picture margins disappear.

Path (1)

To be able to save objects or materials, the operating system needs to be told on which storage medium and in which drawer to save these objects. This is done by specifying a path name.

Path (2)

In an animation, an object can move along a spatial curve. This curve is referred to as a path in Cinema4D. The path can be created by keyframe animation or with a polygon.

Pixel

The smallest graphical unit which can be displayed on a monitor screen is referred to as a pixel (dot).

Polygon

A polygon consists of a sequence of points which are linked by interpolation. A polygon can be used as a contour or as a path.

Rate

Defines the number of pictures per second which Cinema4D is to use in an animation.

Relief texture

Cinema4D can translate the colour data of a picture into height data for the surface of an object. Smooth objects can thereby be assigned a structured surface.

RGB system

Definition of a colour by the red, green and blue components of light.

Scale

Enlarge/reduce.

Scene

A Cinema4D scene includes all objects, materials, animations and settings.

Screen mode

Depending on the screen mode, Amiga computers can use different numbers of colours and different resolutions. There are certain modes (EHB, HAM6, HAM8) which use special tricks to increase the number of available colours but these have other drawbacks.

Sequence

A sequence defines the animation of keys of a particular type between a start and an end point.

SHIFT key

The key marked <Shift>.

Spline

Interpolated polygon.

Texture

Pictures which are wrapped around objects. A texture, however, can control other material attributes than colour data: there are textures for transparency, reflection and refraction.

Track

A track contains several sequences of a particular type. Objects, for example, have tracks for position, orientation and special effects.

Vector

A mathematical arrow indicating a direction. Vectors are defined by their three components (X, Y and Z).

Voxel

Three-dimensional equivalent of the pixel. The Ray-Tracer subdivides the entire scene into square cubes (voxels) in order to accelerate picture rendering.

Workspace

In Cinema4D, the visible section of the document.

Technical Support

Cinema4D comes with 30 days free technical support, starting from the date of registration; therefore you should send in your registration card quickly. Technical support is available by telephone during our Technical Support Hour, by letter or by fax.

Should you wish to receive extended technical support, please complete the relevant sections on the registration card, indicating whether you would like to take up the Silver or the Gold service.

In addition to your name, address and postcode (very important for UK customers), we need payment details before we can accept your extended registration. You can pay by credit card (Mastercard, Eurocard, Access, Visa etc.), UK debit card (Switch, Connect etc.), Eurocheque, UK cheque or Postal Order.

You may have already registered another HiSoft product under our Gold or Silver service; in this case, there is no need to fill out the payment section.

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Notes

Cinema4D™

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